Reporting and Measuring Environmental Impacts of Dairying: Perceptions and Practices

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ABSTRACT

The growing importance of environmental challenges, the majority of which are tied to businesses' continual use of resources, energy, and groundwater, as well as the buildup of environmental-related expenditures, mandates the use of Environmental Management Accounting (EMA). EMA, an extension of traditional management accounting, can be used to monitor and analyse expenditures, profits, and benefits connected to a company's environmental efforts. The objective of this research was to explore the perceptions of environmental impacts of dairying and the practices towards measuring and reporting these impacts.

The sample for this qualitative research study, selected by purposive sampling, comprised farmers, dairy company managers, an environmental regulator, an academic, and an environmental consultant. Semi-structured interviews were used to collect data. The interviews were transcribed and analysed using a thematic data analysis technique.

The study found that people in dairying view environmental sustainability as carrying out their farming and milk processing and distribution as a method of feeding people now while sustaining the current environment so that future generations can enjoy the natural world as it is now. Furthermore, farmers and dairy processing firms recognise the need to alter their current practices in order to reduce the environmental damage they have produced. The findings reveal that dairy farmers and dairy companies in Canterbury use some EMA techniques, with the primary motivation being to comply with the Government's environmental regulations. Other factors that influence the application of EMA techniques are the possibility of high economic returns, support from farm owners, seeking to keep their good reputation, and self satisfaction.

However there are also hindrances to the implementation of EMA techiques. Compliance with environmental regulations is found to be both the main reason for EMA implementation and a hindrance for EMA adoption, because farmers do not understand why some regulations have been set, and how to comply with them. Also they feel that regulators are not in tune with the needs of farmers and the differences between farm conditions. Other barriers to implementing EMA techniques are a short term focus, problems with the information that they are currently managing to collect, organisational siloing, and difficulties in calculating environmental costs and de termining the benefits of implementing EMA techniques.

The findings contribute to the current EMA literature by providing a better understanding of EMA in practice, and in a sector that has not been examined before, namely the dairy industry. The findings may also benefit New Zealand central and local government, and help them to develop their environmental strategies and improvement the current EMA techniques and measurements they are demanding of the dairy sector. Furthermore, this research may help regulators, educators and consultants find ways to educate farmers about the benefits of implementing EMA techniques so they can reduce their operational costs while preventing the negative environmental impacts of dairying.

Keywords: Environmental Management Accounting**,** environmental sustainability, negative impacts of dairying on the environment, dairy industry, Canterbury, semi-structured interviews, farmers.

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Chapter 1: Introduction

1.1 Background Information

Environmental issues such as greenhouse gas emissions, climate change, water pollution, and soil pollution have gained attention both in New Zealand and internationally. In solidarity with the international initiatives that address environmental concerns, the Ministry for the Environment and Statistics New Zealand (2019) worked together with data analysts and scientists to produce an environmental report which determines environmental issues to which New Zealand needs to pay attention. The report revealed that the New Zealand environment is under pressure and the nation has to be aware of actions they take and how they are severely impacting the environment. Based on the data collected, they identified eight various adverse environmental issues: (1) threatened native plants, animals, and ecosystems; (2) soil and water degradation; (3) land and native biodiversity reduction; (4) pollution of waterways in farming areas; (5) environmental pollution in urban areas; (6) freshwater ecosystems; (7) health of New Zealand's ocean environment; and (8) climate change. The New Zealand Prime Minister confirmed in December 2020 that there is now a climate change emergency in New Zealand as the country's net greenhouse gas emissions have increased significantly (Taylor, 2020). To address the environmental issues further, the Government Statistician reviews the environmental reports to ensure environmental reporting is communicated accurately. She stated that the government would continue to improve environmental reporting to enable a better understanding of the impact on the environment of activities conducted in New Zealand (Ministry for the Environment, 2019).

Since environmental problems are now identified as an urgent, critical issue that poses a serious threat against all human activities, proactive measures of companies could help mitigate the negative impacts on the environment. Karimi et al. (2017) propose that environmental

strategies to address environmental concerns be integrated into accounting information about economic performance. For example, businesses could adopt environmental accounting to convey environment-related information to both external and internal stakeholders (Solovida and Latan, 2017). While there are many initiatives for reporting environmental costs externally, Environmental Management Accounting (EMA) has been introduced in the management accounting literature as a way to assist companies to manage natural resources, energy and pollution at the operational level, to help management to consider environmental issues in their decision-making process, and to improve environmental performance (Schaltegger and Burritt, 2010).

Some research has been conducted on EMA in various countries and in a broad range of environmentally sensitive industries including chemicals, mining, and pulp and paper. In New Zealand, dairying is one of the biggest industries and New Zealand is the world's largest exporter of dairy products (Bermingham, 2017; Dairy Companies Association of New Zealand, 2021). However, this industry also produces a large amount of waste, on-farm and off-farm. In addition to that, the dairy processing industry requires energy-intensive processes some of which use fossil fuels as a primary energy source, which eventually results in greenhouse gas emissions as well as increasing other adverse environmental impacts (Tarighaleslami et al., 2019). These emissions have negative impacts on New Zealand people, plants, and animals. The literature reviewed for this study suggests that there is a significant link between farmers and farm owners' perceptions of environmental sustainability and their farm practices. Therefore, this research explores the perceptions of people in the dairy industry about environmental sustainability and the adverse effects of dairying on the environment, and also investigates their practices for measuring and reporting these impacts.

1.2 Problem Statement

A common objective of businesses is to earn a high economic return. However, to achieve this objective, businesses have to intensify their production and this may impact the environment negatively such as for example increased pollution through the processes which companies adopt (Burritt and Schaltegger, 2010). EMA is a helpful tool for measuring and perhaps controlling these negative effects. EMA is an accounting approach that identifies, measures, analyses, and interprets monetary and physical environmental information to assist managers to reduce or reverse the adverse impacts on the environment. (Schaltegger and Burritt, 2000).

According to Gale (2006), a critical role of EMA is to coordinate environmental expenses of corporate stakeholders who may have the ability and motivation to establish methods of minimizing or eliminating the expenses while enhancing the quality of the environment. The aim is to place the environmental effects higher on the agenda of decision-makers by providing participating organisations with a holistic method to deal with environmental issues (Ferreira et al., 2010). This can be achieved by the government enforcing environmental laws or through offering financial incentives for improved compliance. Alternatively, this can be achieved through corporate incentives aimed at fostering sustainable production patterns, passing laws requiring compliance and EMA initiatives led by decision-makers (Arimura et al., 2008).

Studies show that the usage of environment-related information to make informed business decisions remains scarce (Wang, 2017). Therefore this research will contribute to this literature.

1.3 Research Questions

The main aim of this research is to explore the usage of EMA techniques in the dairying industry in Canterbury New Zealand.

The study sought answers to these research questions:

RQ1: What are the perceptions of people in the dairy industry about environmental sustainability in dairying and the adverse environmental impacts of dairying?

RQ2: What are the practices of people in the dairy industry towards measuring and reporting these impacts?

These questions were broken down into the following subquestions:

i. Do people in the dairy industry understand and acknowledge the adverse environmental impacts of dairying?
ii. Are there any techniques, tools or policies in place to measure and report these impacts?
iii. What motivates people to implement these techniques, tools or policies?
iv. What are the hindrances to implement these techniques, tools or policies?

To answer these questions, qualitative research was conducted using semi-structured interviews. This will be discussed futher in Chapter 3.

1.4 Significance of the Study

This study aims to provide insights for researchers and various groups involved in the dairying industry such as farmers, consultants, accountants, regulators and independent organisations about the usage of EMA techniques in the dairying industry. As studies on EMA in New Zealand are scarce, and there are no studies that look into EMA in agriculture, let alone in dairying, this research will contribute to the body of knowledge in EMA literature by providing

a better understanding of people in the dairy industry's perceptions about environmental sustainability and whether EMA enables the measurement and reporting of any adverse environmental impacts of dairying.

As dairying is a significant industry in New Zealand and the impacts of this industry on the environment are increasing, views from different perspectives can help to motivate those involved to work towards mitigating or removing the negative impacts on the environment (Amiruddin, 2016). In addition, this study will explore the practices of various people in the dairy industry towards measuring and reporting the environmental impacts of dairying.

The findings will possibly help the local government and regulators to enhance their current actions to educate and improve the general public and those in this industry' understanding. The findings may also help various people in the dairy industry including farmers, dairy industry representative groups, dairy industry lobbying organisations, environmental consultants, academics, and environmental accountants to work together, to improve the support, and to enhance the implementation of EMA. This might help to improve the environmental performance of the dairy industry in general.

Chapter 2: Literature Review

This chapter will review literature relevant to the research topic and research questions. First the broad topic of environmental sustainability will be introduced, narrowing down to the negative impacts of dairying on the environment. Thereafter, Environmental Management Accounting, which has been suggested as a way to measure and mitigate negative enrivonmental impacts, will be discussed. This chapter will also examine the benefits, motivating factors, barriers and challenges to EMA practices. The final section of this chapter will describe the setting of this research, the New Zealand dairy industry.

2.1 Three Pillars of Sustainability

Over the last few decades, businesses, non-profits, and governments have become more aware of sustainability. However, measuring and pursuing sustainable development might be difficult (Grenville, 2021). Purvis et al. (2019) claims that the concept of sustainability was introduced as early as in the 17th century but the concept has only been actively developed after the Brundtland commission introduced and integrated it into international policy in 1987. According to the Brundtland Report, sustainability means, "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987, p.37). The sustainability concept comprises three interrelated pillars (Schoolman et al., 2012; Boyer et al., 2016): economic, environmental, and social. The details are discussed below.

2.1.1. Economic sustainability

It has been claimed that economic growth is the primary goal of every business, with many companies exploiting natural resources to improve production so that profit will be increased

(Arndt, 1987). To continue achieving economic development, businesses design strategic plans and make decisions focusing on maximising profits while reducing costs.

2.1.2. Environmental sustainability

It is argued that some environmental consequences of the Industrial Revolution, globalisation and economic development include among others soil pollution, water pollution, air pollution, and climate change (Miller, 2020; Karimi et al., 2017). These negative impacts on the environment have become more apparent after environmental disasters such as the Santa Barbara oil spill in 1969, the 1973 Oil Crisis, and media coverage about icebergs breaking off in Antarctica (Purvis et al., 2019). As a result, both external and internal stakeholders are holding businesses accountable and responsible for their actions and decisions that have sprung from their desire to increase production (Karimi et al., 2017). In addition, stakeholders have become more aware of the importance of reducing the negative impacts on the environment and have put pressure on businesses to consider the environmental aspects of their operations.

2.1.3. Social sustainability

Aspects such as a business's commitment to staff, to societies in which the organisation operates, to persons throughout the distribution network, to consumers, and to generations to come are also essential because, collectively, they provide value to the business and enable it to thrive by influencing the business's decisions (Miller, 2020). The social aspect of sustainability includes human rights, health and safety, diversity, work-life balance, and community engagement.

From an accounting point of view, Elkington (2018) tried to incorporate all three pillars of sustainability into a new framework for measuring corporate performance. This accounting

framework, known as the Triple Bottom Line (TBL), goes beyond conventional measures of profit, investment recovery, and share count to considering social and environmental dimensions (Elkington, 2018). The concept of the TBL has gained some popularity in the for-profit, non-profit, and public sectors to assess their financial, environmental, and social performance (Elkington, 2004; Dos Santos et al., 2013; Ferro et al., 2019). Furthermore, organisations are becoming more aware that success is defined by factors other than profit and loss. Svensson et al. (2018) claim that understanding and putting the TBL-based development framework into practice creates opportunities for excellence, innovation, and improvement in all industries and sectors.

However, this study focuses on only one of these pillars: environmental sustainability. Specifically, it explores the implementation of EMA, which Solovida and Latan (2020) recognised as having a significant role in linking the TBL elements by providing valuable information for managers in the decision-making process.

2.2 Environmental Management Accounting (EMA)

Milne (1996) called for accounting professionals to recognise ecological problems such as land degradation and water pollution in accounting activities, as traditional accounting practices tend to neglect the issue of sustainability. Fuzi et al. (2019) argued that criticisms pertaining to the mismatch between accounting information and its application to ecological issues not only apply to external financial reporting but are also relevant to internal information useful for decision making. This is because both types of reporting are interrelated and many companies use external financial reporting to make their decisions on a daily basis or routinely.

Schaltegger and Burritt (2000) define environmental accounting as identifying, collecting, analysing, quantifying, and reporting activities and environment-related information and principles to both external and internal stakeholders. EMA is a subset of environmental accounting which focuses on both monetary and non-monetary information related to a particular firm's operation and its environmental impacts (Schaltegger and Burritt, 2000). EMA information is produced for managers and people within the organisation to help them in planning, controlling and decision-making processes. However, this information can also be useful for external reporting (Fuzi et al., 2019).

Monetary information refers to a company's revenues and expenditures that are reported in monetary units. In relation to the environment, this information includes the cost of resources like water, fuel and power consumption that a company has paid in order to reduce the risk of environmental damage and to improve the environment, the cost of environmental assets, recycling costs, and costs for violating environmental regulations (Burritt et al., 2002). This information can be found either in a central accounting system of a company or from different sites, process or product lines. Non-monetary environmental information focuses on the physical environmental impacts of a company's corporate activities, including the amounts of materials, energy usage, and flows of waste that are likely to have an impact on the environment (Burritt et al., 2002; Qian, et al., 2018a).

Both monetary and non-monetary environmental information are essential for internal purposes to ensure that environmental considerations are taken into account when making decisions. Buritt et al. (2002) suggest three aspects that managers should consider when deciding what to include in the EMA information, namely:

i. The time frame – Is the focus of the decision on the past or the future?

ii. The length of time frame – Is the decision going to last in the short term or the long term?

iii. The routines of information provision – Is the information to be gathered on a regular or ad hoc basis?

Based on the above information, Burritt et al. (2002) developed a comprehensive EMA framework, focusing on the two primary components of EMA (i.e., monetary and non-monetary). They assert that this framework might help an organisation to choose a specific EMA approach depending on the company's focus and orientation (see Table 1).

Table 1: EMA framework

		Environmental Management Accounting (EMA)			
		Monetary Environmental Management Accounting (MEMA)		Physical Environmental Management Accounting (PEMA)	
		Short-term focus	Long-term focus	Short-term focus	Long-term focus
Past/ Present Oriented	Routinely generated information	Environmental cost accounting (e.g., activity-based environmental costing)	Trend analysis of environmentally induced (driven) costs, revenue	Material and energy flow accounting	Environmental (natural) capital impact accounting
	Ad hoc information	Ex post assessment of relevant environmental costing decisions	Post-investment assessment of individual projects	Ex post assessment of short term environmental impacts	Post- investment of physical environmental investment appraisal
Future-Oriented	Routinely generated information	Monetary environmental operational and capital budgeting	Environmental long term financial planning	Physical environmental budgeting	Long-term physical environmental planning
	Ad hoc information	Relevant environmental costing	Monetary environmental project investment appraisal	Relevant environmental impacts	Physical environmental investment appraisal

(Source: Burritt et al., 2002, p. 43)

Monetary EMA is concerned with the environmental aspects of a firm's operation that can be measured in monetary terms (Bennett et al., 2011). This type of EMA is an extended version of conventional management accounting that focuses on ways to track, trace and improve environmental revenues and expenses so that a company can make better decisions to help achieve targeted environmental performance (Schaltegger and Burritt, 2000).

Meanwhile, physical EMA tools emphasise environmental information that can be expressed in physical units. According to Schaltegger and Burritt (2000, p. 261), Physical EMA acts as:

- An analytical tool designed to detect ecological strengths and weaknesses;
- A decision-support technique concerned with highlighting relative environmental quality;
- A measurement tool that is an integral part of other environmental measures such as eco-efficiency;
- A tool for direct and indirect control of environmental consequences;
- An accountability tool providing a neutral and transparent base for internal and, indirectly, external communication; and
- A tool with a close and complementary fit to the set of tools being developed to help promote ecologically sustainable development.

According to Burritt et al. (2002), the framework has been widely used in practice as it guides managers to use combinations of EMA tools based on the company's intended goals and to help them to make informed decisions about long term financial planning and costing determinations. Kamruzzaman (2012) and Doorasamy (2015) suggest that managers do not need to adopt all the approaches in the framework at once and advise, that no specific approach will work for all types of organisations. Instead, this framework is proposed to help managers

to directly assign environmental costs that had been historically concealed in the overhead accounts. In addition, EMA is not bound by standards as is financial accounting, and the scope to/of which EMA techniques are selected will depend on the needs and objectives of companies (Kamruzzaman, 2012).

In practice, the most common EMA tool adopted is environmental cost accounting, which includes various costing approaches such as activity-based environmental costing and material flow cost accounting (Fuzi et al., 2016; Zou et al., 2019). These techniques are adopted more frequently than the future-oriented tools, as companies tend to focus on short-term decision making and the data gathered is generally used to understand their current performance rather than for controlling and planning purposes.

2.3 Benefits of implementing Environmental Management Accounting

The benefits of implementing EMA in organisations include reduction of expenses, innovation, cleaner production, improved pricing of products and services, and increased value for shareholders (Deegan, 2003; Burritt et al., 2010; Burritt and Saka, 2006; Agustia et al., 2019). These benefits enhance the reputation of organisations for introducing environmentally-friendly products into the market and conducting organisational activities with minimal negative impacts on the environment.

Burritt and Saka (2006) evaluated the benefits of implementing EMA for eco-efficiency in some Japanese organisations. They found that organisations that analyse material cost flow are able to determine waste processing costs and losses from processing large amounts of raw material. Other benefits resulting from these analyses are costs saving and providing important monetary and physical environmental information.

EMA information also helps to identify and minimise environmental expenses (Burritt and Saka, 2006; Wahyuni, 2009). Minimisation of capital investments or yearly costs of operations related to the environment can increase profit margins or permit lowering of the prices of products or services, which can, in turn, increase the organisation's market share (Gibassier and Alcouffe, 2018). In a similar manner, minimisation of potential environmental liabilities can minimise legal liability costs and foster access to clients' contracts and financing (Burritt, 2005). For instance, a company that has the ability to determine the actual magnitude and monetary value of its waste products in terms of pollution and waste might be able to discover methods of reducing waste, recovering raw materials and saving funds. Reducing wastewater may reduce the costs for treating wastewater and for upgrading plants in future (Dillard et al., 2005). Also, government agencies responsible for managing solid waste can use EMA information to identify the ideal and most cost-effective services to deal with the waste, e.g., recycling, incineration or landfilling, and to determine which waste has least negative impacts on the environment (Burritt and Saka, 2006).

Futher, EMA enables organisations to obtain data about physical and monetary flow. Such data will enable decision-makers in a company to make decisions that influence both the financial and environmental performance of the company (Burritt et al., 2019). EMA can provide essential information to enhance environmental performance (de Beer and Friend, 2006; Alvarez et al., 2021). For instance, in organisations that consider the cost of wasted raw materials as an environmental cost, most processes of production would have some environmental costs attached to them, and managers could use the information to reduce environmental impacts while enhancing their production costs.

In summary, implementing EMA has several benefits for an organisation. It may assist businesses to determine waste processing costs, identify and minimise environmental expenses, reduce legal liability costs, and help managers make informed decisions. Given the benefits of implementing EMA, the next section will explore what factors motivate managers to adopt EMA.

2.4 Factors motivating adoption of Environmental Management Accounting

In Malaysia, Jamil et al. (2015) found that membership of a training and accounting body may encourage a company to adopt EMA. Similarly, the Association of International Certified Professional Accountants (AICPA) (2019) found that Sri Lankan companies that have adopted EMA are very open to share their EMA knowledge and have the ability to train their accounting employees, which seems to play a significant role in the development of knowledge and competence in the adoption of EMA practices.

AICPA (2019) identified three main reasons for the adoption of EMA: reputation, cost savings, and process innovation. In companies both in Australia and Sri Lanka, EMA practices play a vital role in gaining legitimacy. However, Australian companies pay more attention to the reporting side: they use EMA to improve their reputation, to attract potential investors and to satisfy existing investors' needs. The motivating factors for Sri Lankan companies are cost-saving and process innovation. These companies see EMA as an opportunity to penetrate new markets, and as a profit-generating opportunity in the creation of green products in the future.

Qian et al.'s (2018a) study of local government in Australia shows that social norms and organisational structure motivate the development of EMA for waste management. Karimi et al. (2017) also claim that organisational culture in dealing with environmental issues is the

most significant motivating factor for organisations in petrochemical and oil refining companies to use EMA tools.

Some studies use institutional theory to explain the motivating factors for EMA implementation (Hussain and Gunasekaran, 2002; Jamil et al., 2015). According to this theory, an organisation's behaviour pertaining to adopting and adapting new practices is influenced by coercive, normative, or mimetic factors. Coercive factors refer to regulations making it mandatory for an organisation to comply, such as a specific accounting standard enforced by law (Zucker, 1987). Normative factors can be regarded as enforcement that comes from a shared sense of what is appropriate (Berthod, 2016), such as voluntary adoption of EMA to reduce the risk of getting sued or fined in the future. Mimetic factors are responses of a firm to proven techniques or practices of competing firms when faced with ambiguous and uncertain situations (DiMaggio and Powell, 1983), in this case, adopting EMA because they see that other successful or competing firms are using it.

The literature also found that coercive factors such as government environmental standards, and pressure from local communities and financial institutions are the most influential motivating factors for adopting EMA (Husain and Gunasekaran (2002) and Jamil et al. (2015). Although these scholars argue that coercive factors are the most influential, normative and mimetic factors also impact the implementation of EMA. Contrary to this, Wang et al. (2019) and Li (2004) state that companies in China do not see mimetic pressure as a motivating factor when implementing EMA. Also, they found that when top management actively supports the implementation of EMA and when the perceived benefit is high, then mimetic pressure is less likely to be a point of concern in terms of the implementation of EMA. Bennett and James (1998) suggest that companies tend to follow their own rules instead of imitating their

competitors' actions in relation to EMA as there are no specific standards and methods regarding the implementation of EMA.

Even though EMA facilitates the making of internal decisions, it does not guarantee a certain level of environmental or financial performance or that environmental performance will necessarily improve. Hence, the next section will identify the barriers to implementing EMA.

2.5 Barriers to Environmental Management Accounting implementation

Various studies report on barriers to the implementation of EMA. According to Mat Yusoh and Tuan Mat (2020), resource constraints and financial considerations greatly hinder EMA adoption in hotel firms in Malaysia. In addition, other barriers for small and medium hotel companies are difficulties in collecting and allocating environmental costs, a lack of government and legislative pressure, and a lack of interest among the stakeholders. Olalekan and Jumoke (2017), Govindan et al. (2014), and Bhandari et al. (2019) reported similar findings in Nigeria, South Africa, and India respectively. These studies found that institutional and financial barriers are the major hindrance to EMA practices. Institutuinal barriers include pressure from the government, while financial barriers include resource constraints, and uncertainties about the economic benefits of EMA implementation.

Interestingly, these researchers also found that other barriers such as outsourcing barriers (including lack of government support and knowledge, and absence of environmental expert employees), and technology barriers (such as lack of new technology and absence of technical expertise) also cause problems for EMA implementation (Walker et al., 2008; Mathiyazhagan et al., 2013; Govindan, et al., 2014; Bhandari et al., 2019; Álvarez et al., 2019; Menon and Ravi, 2021)

In addition, Papaspyropoulos et al. (2012) did a case study to explore whether EMA might improve the environmental reporting of a nonprofit forestry organisation and able to give valueable results so that the organisation may enhance their decision making. This study reported that although the organisation has a high quality financial accounting system, the said system does not capture environmental information effectively. This study further found that inefficiency in identifying which information shall be captured under EMA and no clear measures of EMA were the barriers to EMA adoption, resulting in the organisation failing to address all the environmental issues in their operations.

Also, Setthasakko (2010) discovered that a lack of organisational learning, a lack of guidance on how to do environmental accounting, and a concentration on economic performance also hinder the development of EMA. Meanwhile, Keenan et al. (2019) and Álvarez et al. (2019) reported that structural and governance deficiencies, language complexity, inadequate public and private leadership, and lack of sustainable long-term investment as barriers to measuring and reporting environmental impacts. Additionally, Jamil et al. (2015) reported that a low budget allocation for EMA activities as another barrier.

Once the decision is made to adopt EMA, there are also challenges in getting EMA to work in companies. These challenges will be discussed next.

2.6 Challenges in implementing Environmental Management Accounting

Research conducted by Ferreira et al. (2010) indicated that reporting environmental sustainability is beginning to take up a big a role in reporting as sustainability problems and issues become a major concern for the external stakeholders. Good organisational management

has become a major sign of success for any given organisation as expectations of the stakeholders constantly change and are oriented to responsibility (Burritt, 2005). In order for any given organisation to develop an interest in EMA, there must be a financial benefit to them and the stakeholders as expected.

Several challenges to the ongoing use of EMA could also be found at an operational level (Deegan, 2003). For example, management accountants may have limited knowledge about the ramifications for the organisation on the environment, which makes them not emphasise on environmental costs when reporting accounting information is one of the challenges to EMA implementation.

In addition, lack of communication between environmental and technical staff, who has a significant amount of knowledge regarding environmental issues such as water flows and enegy usage with the management accountants can also limit the EMA implementation (Savage and Jasch, 2005). This is because their goals and perceptions of EMA practices might be different, which results in poor developed link between these three employees.

Furthermore, managers may find it difficult to isolate and measure environmental costs because of poor and weak systems (Dillard et al., 2005). For example, environmental costs are often "hidden" in overhead accounts without being directly assigned to products or processes that they relate to. With no adequate tracking of the information about the costs, there will be difficulty in preparing EMA reports and measures (Burritt, 2005). Also, some environmental costs may be ignored if there is no adequate information in the typical accounting systems. Therefore, despite considerable research which has refined methodologies of managing

environmental cost accounting, practical applications of these methodologies have not been widespread (Deegan, 2003).

A review of the implementation of EMA is provided in the next section.

2.7 Implementations of Environmental Management Accounting

Ferreira et al. (2010) found that the usage of EMA depends on the industry. They argue that organisations in more environmentally-sensitive industries would be more favourable towards environment-related accounting. In their study, sensitive industries such as mining, chemical, and petroleum industries tend to prioritise environmental considerations compared to industries like retail and services. However, Frost and Wilmshurst (2000) did not find any evidence that environmental sensitivity of industries to be the main driver for EMA adoption. Instead, they asserted that environmentally sensitive industries adopted EMA more actively than the non-sensitive industries. They concluded that the primary reasons for implementing EMA are regulatory compliance requirements and regulatory restrictions rather than the general commitment to environment-related management accounting.

Many researchers have identified the strategic competitive advantages of the tools suggested in the EMA framework (Qian et al., 2018b; Gibson and Martin, 2004; Karimi et al., 2017; Sands et al., 2016). Hence, researchers suggest there is a demand for EMA as a way to manage and minimise environmental effects (Sutherland et al., 2008).

As managers can choose which EMA techniques to adopt and there are no rules about how to use these tools, adoption varies greatly. Ejoh et al.'s (2014) study on manufacturing companies in Nigeria revealed that these companies are still combining environmental-related costs with

other expenses due to a low level of awareness of EMA. In India, Chakraborty and Roy (2018) found that a paperboard and paper production unit had adopted EMA but did not maintain or monitor the environmental costs effectively. Similarly, Sutherland et al. (2008) and Chang (2007) found that in universities only some indicators of environmental costs have been adopted, such as the usage of petrol and diesel, whereas the utilisation of EMA tools to assist management in decision making and planning is scarce.

Conversely, the AICPA's (2019) study on the usefulness and implementation of EMA practices in Australian and Sri Lankan leading companies showed that almost 50% of the companies had used EMA tools such as carbon accounting for more than five years or have begun to implement this tool in the last five years. However, it can be concluded that the potential uses and advantages of EMA are still not being implemented by companies, and EMA implementation has been given a lower priority than other management accounting methods (Jamil et al., 2015). However, EMA has the potential to become a mainstream component in decision-making as more companies are aware of environmental repercussion on their firms and start implementing EMA.

This section shows that EMA implementation is gaining importance and is increasingly becoming a common practice in organisations (Gunarathne and Lee, 2015). In addition, as EMA is at the operational level and it is a tailor-made tool (i.e., there are no standard policies and techniques for how to use EMA), the implementation of EMA will vary.

Although the literature has explored EMA implementation in various industries, there is little related to the current research project's area namely agriculture, which is a key primary industry in New Zealand, particularly dairying. The national dairy herd increased by 70%

between 1994 and 2017, in a significant shift from sheep and beef farming into dairy farming (Ministry for the Environmental and Statistics New Zealand, 2019). As this is expected to have a negative impact to the environment in terms of the soil quality, water quality and quantity, air quality and biodiversity conservation (Ministry for the Environmental and Statistics New Zealand, 2019), EMA may help to mitigate the possible effects. The next section will provide the focus for this study, by providing the context of the New Zealand dairy industry and its environmental issues.

2.8 Dairying in New Zealand

The dairy industry comprises businesses producing milk on dairy farms and processing dairy products such as milk, butter, ice cream, cheese, and yogurt. These activities take place on dedicated farms that focus on harvesting milk (Aziz et al., 2019). The dairy industry's geography differs from one nation to another because each nation produces its milk products in a different way (Eastwood et al., 2016). For instance, in major milk-producing nations such as Australia and Ireland many big large-scale processing companies are owned by farmers' cooperatives, while in the United States, dairy companies and farmers operate through private contracts (Bethune and Armstrong, 2014). Further, in developing nations, the ancient practice of farmers selling their milk in their neighbourhoods has changed over the past few decades due to increased dairy industry developments and the improved role of dairy cooperatives (Eastwood et al., 2016). As a result, milk production in developing countries is increasing rapidly, giving more income to the farmers and their countries. Although New Zealand is a developed country, approximately 70% of their farms remain owner-operated as they have been for almost 200 years (Dairy Companies Association of New Zealand, 2021). The dairy industry in NZ is one of the country's biggest industries, producing around 21 billion litres of milk every year (Dairy Companies Association of New Zealand, 2021). It is also the world’s

largest exporter of some dairy products such as whole milk powder (Granwal, 2021) and butter (Bermingham, 2017).

Dairy farming in New Zealand began in the early days of colonisation by the Europeans but it was not an important source of income in the country. Previously, sheep farming was the most vital industry in New Zealand and most of the lands in Canterbury were used for sheep farming to produce fine wool and frozen meat (Stringleman and Peden, 2008). However, the New Zealand dairy industry has grown substantially during the past few decades especially in Canterbury region, where land used for dairying has increased by nearly 90% between 1980 and 2009 and their total production escalated by fifteen times (Pangborn and Woodford, 2011). This happened because the Canterbury area is flat and easy to irrigate. Furthermore, the price of land in Canterbury was cheaper than other areas in New Zealand and the adoption of new technologies has led to farmers changing from sheep farming to dairying.

Initially, dairy products were primarily intended for domestic markets, with a small proportion being exported to Australia. After developing refrigeration technology, the United Kingdom (UK) became the most significant overseas outlet for New Zealand dairy products (Eastwood et al., 2016). However, after the UK joined the European Economic Community in 1961 trade barriers increased and exports of dairy products to the UK declined significantly. This encouraged the New Zealand dairy industry to find other markets, particularly in South East Asia, and to diversify their items (Shadbolt et al., 2017). By the beginning of the 21st century, the New Zealand dairy industry had become the world's largest exporter of dairy products. The New Zealand dairy sector provides more than 15 billion New Zealand dollars on average to the nation's economy every year, and dairy products are among the country's most commonly exported goods.

According to Granwal (2020), New Zealand produced 21.8 million tonnes of milk in 2019. Also the average size of a dairy farm was 155 hectares, mainly due to increases in the average size of herds (Granwal, 2020). While the intensification of dairying brings economic benefits to New Zealand and supplies food to many countries, dairying also has negative impacts on the environment.

According to the Dairy Companies Association of New Zealand (DCANZ), New Zealand is able to produce vast milk quantities because the climate, sufficient water, and fertile soil provide an ideal environment to grow grass (Pangborn and Woodford, 2011). Besides that, being an island, New Zealand is almost free from many pests and animal infections present in other parts of the world (Pangborn et al., 2015). These aspects offer the country a strong base for farming with less challenges. However, to maintain international competitiveness and increase productivity, the use of inputs such as fertiliser and cleaning products has intensify. As a result, this industry does faced environmental challenges such as climate change, pollution of freshwater and nutrient pollution (Parliamentary Commisioner for the Environment, 2004; Jay and Morad, 2007; Monaghan et al., 2007; Flemmer and Flemmer, 2008). As a result, the New Zealand dairy industry receives widespread public criticism of its environmental impacts.

There are various processes that occur in the dairy chain, from growing of grass for feed, milk production on farms, cleaning of the milking shed, shipment of milk to factories by tankers, and processing milk into various finished goods including pasteurised milk in bottles, milk powder, butter and cheese (van Asselt et al., 2016). Milk is usually processed in two ways: firstly, heat treatment to eliminate harmful microorganisms that might be present, ensure that it is safe for human consumption, and extend its market life; and secondly, condensing the

dairy products into milk powder, hard cheese, and butter to facilitate storage (van Asselt et al., 2016). During all these processes in the dairy chain, waste and emissions are generated.

The Ministry of Primary Industries in New Zealand (MPI) studies the environmental problems that farmers and dairy companies face on an ongoing basis. MPI identifies dairying's usage of energy sources that produce greenhouse gases, and land, water and waste management processes that have negative impacts on the environment (The Ministry of Primary Industries, 2019). MPI also predicts that climate change is one of the biggest impacts expected in future.

In addition, greenhouse gases emissions such as carbon dioxide, methane and nitrous oxide affect the environment directly. These gases make up to almost half of New Zealand's gross emissions (Tarighaleslami et al., 2019). This amount has increased by more than 50 percent from 1990 to 2018 (Ilyas et al., 2020). Methane, which comes from cattle, comprises the largest proportion of those emissions (i.e., 43%). Besides that, nitrous oxide from agricultural soils mainly come from the urine and manure of grazing animals as well as synthetic nitrogen fertiliser, which is converted to nitrous oxide by soil microbes. This type of gas is called a long-lived gas that will remain in the atmosphere for almost 120 years. Although New Zealand has the lowest carbon footprint for milk in the world, half of the emissions come from agriculture (DairyNZ, 2021). Hence, actions to reduce the emissions are crucial to improve the environment. Energy is also an essential input and expense for dairy farming industry, which also contribute to greenhouse gases. According to Ilyas et al. (2020), this input can be grouped into two kinds of energy inputs: direct and indirect. Direct energy inputs in dairying cover the *direct application of energy forms to the required process* (Podstolski, 2015). They include: diesel and petrol consumption for tractors and heavy trucks used on farms and for tankers getting milk to processing plants, electricity usage for irrigation, fossil fuels for processing

plants, and human and animal labour. Indirect energy inputs in dairying refer to the *embodied energy in products applied to processes* (Podstolski, 2015). Indirect inputs include fertilisers used to improve soil nutrient level on-farm, feeding supplement usage such as grass silage, maize, hay, and grains, milking shed, and machinery. Both inputs contribute substantially to the production of CO_2 gases, both on-farm and off-farm. According to Yenamandra (2016), the New Zealand dairy industry is considered to use high energy in their production processes. Many milk-processing companies utilise fossil fuels as their primary source of energy, which generates greenhouse gases and results in other harmful environmental impacts (Yenamandra, 2016). To combat the negative environmental effects of these fuels used in dairy processing companies, it is important to develop a course of shifting from the utilisation of fossil fuels to renewable energy.

Water quality is also an issue in New Zealand's environment as it is a critical resource not only for human needs but also for aquatic life. Due to dairying, excess nitrogen, chemicals, sediments and soil phosphorus enter freshwater bodies such as rivers and lakes, contributing to water pollution (Parliamentary Commissioner for the Environment, 2013). For example, some New Zealand lakes, such as Lake Taupo in the North Island, and Lakes Forsyth|Wairewa and Ellesmere|Waihora in the South Island have had outbreaks of toxic algal blooms and loss of wildlife such as fish and eels and waterbirds (Parliamentary Commissioner for the Environment, 2013).

This intensification of agriculture, specifically dairying is impacting the quality of soils. In particular, 51 percent of tested dairy sites had excess soil phosphorus and 65 percent of tested dairy sites were below the target range for microporosity (Ministry for the Environment & Stats NZ, 2018). Land management, one of the most common issues identified by the Ministry of

Primary Industries, encompasses the sustainable application of fertilisers, understanding how to control the amount of nitrogen utilised, and having good waste management practices. The Ministry of Primary Industries (2019) claims that dairy farmers often have challenges accessing clean water for themselves and their animals, especially due to poor irrigation practices and not knowing how to maintain high-quality water in waterways.

New Zealand dairy industry also produces various kinds of wastes, the major ones including plastics, agrochemicals, and dead stock. Other wastes include fertiliser bags, tyres, used oil, batteries, scrap metals, treated timber, needles, and syringes.

2.9 Farmers' Perceptions and Environmental Practices

Perception can be defined as an activity whereby a person acquires knowledge using their senses and, consequently, forms an impression, judgement, opinion, understanding, view, or interpretation based on the information received. (Kawung, Poluan and Rondonuwu, 2016, as cited in Prasada and Masyuri, 2020). In addition, perception enables a person to respond to the provided input (Kawung, Poluan and Rondonuwu, 2016, as cited in Prasada and Masyuri, 2020). Some prior studies have evidenced the relationship between farmers' perceptions and their practices targeted at reducing the negative impacts on the environment.

A study conducted in Mexico by Torres, Kallas, and Herrera (2020) investigated farmers' environmental perceptions and practices towards reducing climate change. The study found that those farmers who view climate change as an essential ecological issue are more willing to implement actions that might help to mitigate this issue. Also in the same study, farmers with eco-centric views on climate change are more likely to invest in less polluting machinery to achieve environmental sustainability. These findings are similar to a study conducted in

Mongolia which found that Mongolian wheat growers who perceive that soil erosion is severe are more likely to adopt sustainable agricultural practices (Puntsagdorj, Orosoo, Huo, and Xia, 2021).

However, Kiełbasa et al.'s (2018) research in Poland on farmers' perceptions and practices in relation to nutrient management found that although most respondents view environmental sustainability as a vital and inseparable component of their daily operations, some of them were more concerned with financial performance. In addition, the farmers will only consider making adjustments to their current practices to improve nutrient management if they expected favourable economic results.

Da Motta and Ortiz (2018) also confirmed that Brazilian farmers' perception of environmental issues and understanding of environmental programmes to improve adverse ecological impacts are related to their adoption of practices that contribute to the mitigation of the degradation of Brazil's grazing areas. They found out that participants who believe the environmental programme "Payments for Ecosystem Services" is essential for flood control and that climate change is a critical environmental issue that needs attention are more inclined to participate in that programme.

Furthermore, a study in Turkey by Tatlıdil, Boz, and Tatlidil (2009) on farmers' perception of sustainable agriculture revealed that agricultural practices which reduce the negative impacts on the environment, such as not burning residues after harvest, proper irrigation, and improved use of pesticides are not only influenced by their environmental perceptions but are also a product of their current farming system and their farming experiences.

2.10 Chapter Summary

There is limited research conducted explicitly on the relationship between dairy farmers' perceptions of and practices for reducing adverse impacts on the environment. One study was found which collected data from 524 European dairy farmers seeking to examine the relationship between their perception of sustainability and future farming strategies (Creemers et al., 2019). The study revealed that dairy farmers' beliefs about sustainability influence their choice of farming strategies aimed at achieving environmental sustainability. For instance, dairy farmers are more likely to reduce their existing production scale if they perceive that this production choice will reduce the negative environmental impacts of dairying. However, there does not appear to be any prior research exploring the perception of the adverse impacts of dairying on the environment by people in the dairy industry and their practices towards measuring and reporting these negative impacts. Also there are no studies of this issue in New Zealand. Hence, this research will add insight to the body of knowledge regarding the relationship between participants' perceptions of environmental sustainability and their practices for measuring and reporting the adverse impacts of dairying on the environment.

Chapter 3: Research Methodology

This chapter describes the research methodology employed in this study to find answers to the research questions. This chapter will be discussed as follows: First, in Section 3.1 the research philosophy is explained, then, the research approach is described in Section 3.2, followed by Section 3.3 the research sample. In Section 3.4, ethical considerations are considered. Consequently in Sections 3.5 and 3.6, how the data were collected, transcribed and analysed are discussed. Finally, a concluding section about the whole chapter is found in Section 3.7.

3.1 Research Philosophy: Interpretivism

This study explores the varying perceptions of the environmental effects of dairying and the usage of Environmental Management Accounting techniques in the dairying industry in Canterbury, New Zealand. Specifically, this research intends to find answers to the research questions stated in chapter 1, namely:

RQ1: What are the perceptions of people in the dairy industry about environmental sustainability in dairying and the adverse environmental impacts of dairying?

RQ2: What are the practices of people in the dairy industry towards EMA especially in terms of measuring and reporting these impacts?

According to Johnson and Clark (2006), the researcher's research philosophy determines how the researcher will carry out their study. This current study takes an interpretivist stance. Interpretivism, often known as social constructivism, is a type of research in which researchers subjectively interpret aspects of a study (Saunders et al., 2009). Interpretivism is concerned with the in-depth elements and aspects of a situation, and it considers people to be distinguishable from physical phenomena and that human beings cannot be investigated in the

same way that different physical elements can. That is, social science research is different than research in the natural sciences (Alharahsheh and Pius, 2020).

The interpretive paradigm is adopted for this research as it relates to social concerns that is realistic, multi-layered and complex, and in which a single phenomenon can have multiple interpretations (Saunders et al., 2009). This study sought the participants' subjective perceptions of environmental sustainability and the adverse environmental impacts of dairying. In addition, this research explored the practices of people in the dairy industry in relation to measuring and reporting these impacts. To help the researcher better understand how people in the dairy industry interpret what they perceive and thus to find answers to the research questions, an inductive research approach was chosen (Saunders et al., 2009; Creswell, 2012).

3.2 Qualitative Research Approach

This research adopted a qualitative approach as the focus is on enhancing the understanding of participants' perceptions, and the usage of EMA in the New Zealand dairy industry. Qualitative research, which seeks to answer questions of 'why' and 'how', are the best way to study people's attitudes, ideas and meanings they attribute to situations they find themselves in (Saunders at al., 2009). Qualitative research methods include interviews, observations and analysis of documents.

DeJonckheere and Vaughn (2019) believe that semi-structured interviews are effective when the researcher's topic has a social focus, which most certainly includes active involvement and interest, while also enabling the researcher to practise his/her interviewing skills to improve data quality. To collect in-depth information from participants, this study used a semi-structured interview as a qualitative research approach for the following reasons:

- Independent views and thoughts of each individual interviewee from the dairy industry were needed
- The researcher was unsure whether the term Environmental Management Accounting is widely used and familiar to those in the dairy industry. Thus this method enabled the researcher to re-word questions and make explanations of terms
- The participants' perspectives on and practices for measuring and reporting the negative environmental impacts of dairying could not be effectively addressed without more open-ended questions and extended probing
- The respondents were able to freely disclose their perceptions, thoughts, experiences, and practices without constraint

Before conducting the semi-structured interviews, the researcher developed a protocol guide keeping in mind the following:

- Make sure the researcher is prepared for the interview: The researcher made a list of the information to explore with the interviewees, and which aspects of the topic respondents' were required to expand on.

- Develop an Interview Guide: From the list of information that the researcher intend to explore, the researcher developed a guide of possible questions to ask (see Appendix 4). As the interviews were semi-structured, the questions were flexible, and more or less questions that could be asked of each interviewee.

- Introduce the researcher's background and establish rapport: The first questions were asked to get to know each other, and to explain the goal of the interview before asking questions related to the research.

- Begin with easy questions and work up to more difficult ones: The interview guide was designed so the researcher started by asking simple questions before getting to more difficult topics about controversial opinions.
- Know when to call the interview to a close: Although no interview was expected to last more than an hour, the researcher ended the interview after obtaining detailed answers to the questions.

3.3 Research Sample

This study focused on the New Zealand dairy industry. Participants were selected from the Canterbury region in the South Island of New Zealand, as it is the second largest region of dairy farms in New Zealand after the Waikato region and the largest in the South Island. When selecting the participants for the research, the researcher employed purposive sampling. In purposive sampling, the researcher chooses specific people to be included in the study which consisted of five farmers, two managers from dairy companies, an environmental regulator, an academic, and an environmental consultant.

For the selection of the sample in this research, some criteria needed to be met. Firstly, the farmers had to be the farm owners or farm managers. For dairy companies, the participants had to be someone involved in the company's decision-making. The researcher also interviewed various other people, in the dairy industry who could help the researcher to answer the research questions. This set-up was deemed necessary as their inputs enhance the knowledge of farmers and dairy company practices towards measuring and reporting environmental impacts of dairying. The participants from various other people, whom the researcher called “referrals”, in the dairy industry were identified through initial contacts made in each of the organisations.

This referral set-up was deemed necessary by the researcher because it is the people from the dairy industry who know best about their fellows that can provide value to the research. The researcher outlined the criteria and provided to all participants a brief explanation about the study to the proposed interviewees. This has lead to a confirmation of potential participants, and then after suitable participants have agreed to be interviewed, the researcher discussed the interview process. Interviews were conducted with five farmers, two managers from dairy companies, an environmental regulator, an academic, and an environmental consultant.

Table 2: Interviewees

Interviewee	**Duration (minutes)**	**Role**	**Rationale for inclusion**
Farmer 1	60	Farm owner	Contributes to the decisions relating to environmental issues and has immense knowledge about the decision-making process in the organisation.
Farmer 2	80	Farm owner	
Farmer 3	30	Farm manager	
Farmer 4	55	Farm manager	
Farmer 5	45	Farm owner	
Dairy Co.1	70	Manager	
Dairy Co.2	60	Manager	
Regulator	46	Principal Advisor at ECan	Provide local policy perspective and broader overview of the role of ECan in protecting the environment. The Regulator also worked as a farmer before, which helped the researcher to understand the challenges farmers face from both perspectives; farmers and regulator.
Academic	30	A lecturer Canterbury	Provide information that can help the researcher to understand dairying management in Canterbury. The Academic is also working with farmers to address environmental concerns in dairying.
Environmental Consultant	40	A consultant in Ashburton area	Consults about the environmental decisions from the NZ government and the local council pertaining to regulatory requirements, provides expertise on environmental assessments in dairying and gives information that can help understand farmers' practices towards mitigating the environmental impacts of dairying.

3.4 Ethical Considerations

Before commencing the research, the researcher seeked for approval to conduct interviews from the University of Canterbury Human Ethics Committee, which was granted (HEC Ref: HEC 2020/18/LR). This research is considered as low risk as it does not raise any issue of deception, threat, invasion of privacy, and does not involve gathering personal information of a sensitive nature about any individuals. Before beginning the interviews, the researcher double-checked that all participants were aware of the study's purpose and gave their informed consent. The researcher told the potential interviewees that the results would be shared with them if they requested it, in order to ensure transparency. To ensure participant confidentiality and anonymity, the names of the organisations and the information provided by the respondents were not included in this thesis.

3.5 Data Collection

After obtaining approval from the UC Human Ethics Committee, participants were invited via email obtained through their organisations' websites to participate in the project. The emails set out the purpose of the research and asked whether the potential participant was willing to be interviewed. In addition, an Information Sheet and a Consent Form were attached to the email (see Appendices 1 and 2). Participants replied by email expressing their interest and returning the signed Consent Form. Interview dates, times and venues were then arranged.

The interviews took place at a location agreed upon by both the participants and the researcher. When face-to-face interviews were conducted, a suitable place with minimal distractions was chosen to improve the quality of data collected. In total, nine interviews were conducted face-

to-face with farms (two), in the office of the participant (four) and in cafes in Christchurch (three). One interview was held by Zoom. All the interviews were recorded with the consent of participants, which enabled the researcher to transcribe the interview and make further analysis.

3.6 Transcription and Data Analysis

Immediately after completing an interview, the recording was transcribed. This enable that the transcription could be updated with field notes taken during the interviews so as to review and revise the research questions to be asked for the next interview. The field notes recorded details about the location and time, how the interview went, the participants impressions during the interviews, and potential questions for future interviews. Once all interviews were conducted, a thematic analysis of the transcripts was conducted using the process outlined by Braun and Clarke (2014): becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining themes, and writing-up.

Initially, all transcripts and field notes were read through so as to obtain an overall view of the data collected. Thereafter, the transcripts were coded manually to generate initial codes and to categorise them into the several themes of the questions asked during the interviews. The computer package, NVivo, was also used in the coding process. The themes were continuously reviewed, and the researcher modified the themes so that the data supported the themes and she ensured that the themes were relevant to answering the research questions. Finally, the researcher started writing the findings and discussion chapters, Chapters 4 and 5 of this thesis, respectively.

3.7 Chapter Summary

This chapter reviewed the research methodology that was utilised. Interpretivist stance, qualititative research with semi-structured interview were employed. The research sample, ethical considerations, and steps to analyse the data collected were explored. The next chapter reports the findings of the study.

Chapter 4: Findings and Analysis

4.1 Introduction

This study explores the perspectives of people from the dairy industry on the environmental impacts of dairying and how it impacts their decision-making in terms of EMA techniques implementation. This chapter will mainly focus on the findings from the semi-structured interviews conducted among farmers in the Canterbury region and employees in dairy companies which provide some answers to the research questions. The interviews with a policymaker, an academic and an environmental consultant supplement these findings to enable a more in-depth understanding of how dairy businesses in New Zealand account for their impacts on the environment.

The findings are presented in three categories. Interview data collected from farmers in the Canterbury region are presented first. Secondly, interview data from the perspective of dairy companies are presented, providing their views and experience regarding their dealings with both the farmers and the regulators. The data collected from participants with various other roles related to the dairy industry are presented last.

Apart from presenting the data from the interviews to answer the research question, this chapter also provides suggestions from the interviewees about how to improve the dairy industry so that it can account for environmental impacts while still making a profit.

4.2 Interviews with Farmers

In total, five semi-structured interviews were conducted with farmers from Canterbury. Table 4.1 exhibits the duration of each interview.

Table 3: Duration of interviews with dairy farmers

Interviewee	**Duration**
Farmer 1	60 minutes
Farmer 2	80 minutes
Farmer 3	30 minutes
Farmer 4	55 minutes
Farmer 5	45 minutes

To analyse the interview data and to identify themes from the participants' responses, the researcher used NVivo 12 software. The auto-coding technique of NVivo was used at the initial stage keeping in view the common themes of the interviews. The interviews first explored dairy farmers' perspectives on environmental sustainability, whether they currently use any EMA techniques, reasons for implementing these EMA techniques, barriers to using EMA, and finally their suggestions about how to improve the identification and management of environmental costs and information. Accordingly, the results are discussed in these categories. Some of these discussions include additional themes and sub-themes identified in the interviews.

4.2.1. Farmers Perceptions of Environmental Sustainability

Farmers are critical players in the dairy industry so it was important to interview them to find out their opinions about environmental sustainability. Farmers have to manage and control the daily production of the farm, and at the same time have to manage the finances of the business.

Thus, they have to have sufficient knowledge and information to make decisions about their farms. Overall, for the farmers interviewed, environmental sustainability in agriculture means to be able to supply food to people while continuing to maintain or improving the environmental impacts of their operations so that future generations can still enjoy nature as we do today. Farmer 1 stated: "*… I think a hundred percent we have to do it … it's good for us and it's good for the environment. It's good for our kids. It's good for everyone, and we want to do that because it's the right thing to do*." Farmer 4 said: "*…, so I guess at the end of the day, what sustainability means to me is to make sure that my generation don't just extract all the golds and just leave the silver and bronze for my future generations*".

Besides that, Farmer 4 highlighted what the future would look like if businesses are not environmentally sustainable, saying:

> *If you take yourself out of your farmer hat and you put your food producing hat on, it makes you feel pretty sick. To be fair, some of those things that you're responsible for, my kids drink that water, so that's probably what I look at sustainability as if I have my farm, it's to make sure that my kids can carry this legacy on* (Farmer 4).

One farmer, who recently took a course on sustainability education, claims that environmental issues are a priority that needs to be addressed as a matter of urgency: "*… at the end of the day it's more that sustainability as a whole thing. If you … don't have enough things in place to be environmentally sustainable, you're not going to be financially sustainable*" (Farmer 2).

The interviews indicate that all farmers are aware of the environmental impacts of dairying caused by the intensification of their economic activities. However, it appears that they are more concerned about their business's financial sustainability and economic performance than

the environment. One possible explanation might be because "*it looks like farmers don't want to do things we can't see*" (Farmer 1). As the economic outcome of dairying is more obvious and more tangible than the ecological conditions of dairy farming land, farmers are focusing on ways to increase their farm production, which improves the economic performance of their business.

The news media and many reports have exposed the adverse impact of intensive dairying on the environment, which has put a lot of pressure on farmers. Hence, dairy farmers are aware of the need to improve the environmental state of farms in New Zealand, especially of dairy farms. *"Environmental sustainability is very important at the moment as it is such a big public concern and strong feeling from farmers now that actually 'if we do not get this right, we will need to shut down'"* (Farmer 3).

The farmers' responses showed that they understand and are aware of the environmental impacts of dairying. Although farmers say they care and are concerned about environmental sustainability, their actions to maintain or reduce the adverse environmental impacts of dairying might not demonstrate this. This might be because "*we've got generations that've come through to inherit the businesses without prior understanding of what drives the industry, and they failed to realise what was happening and assumed that it is all about making profits" (Farmer 3).*

4.2.2. Current EMA techniques used

Specific questions were asked during the interviews to determine whether farmers are currently using any EMA techniques. Only one of the farmers has an accounting background and understood what is meant by EMA. All the others were unfamiliar with the term "Environment

Management Accounting". However, when other terms and concepts were used to describe EMA, for example, environmental strategies and tools anywhere in their supply chain, all farmers were able to give examples. For example, Farmer 4 mentioned: "… *we do reporting on our environmental performance, our social performance and our financial performance. So yes, we are reporting environmentally, and we have some metrics that we choose to use, and we report to those*".

Three particular techniques were specified in the interviews, namely, the preparation of a Farm Environment Plan, the use of environmental software packages, and the creation and usage of environmental-related cost accounts. Details are provided below.

Farm Environment Plan

The first EMA technique identified is a Farm Environment Plan (FEP). In Canterbury, every farmer must prepare a FEP, as noted by one of the interviewees: "*we can't farm without environment consent, effluent consent and irrigation consent. Most of it is in the Farm Environment Plan or part of the irrigation scheme*" (Farmer 1). The FEP is required by the Canterbury regional council to help farmers recognise environmental risks on their farms and make them set out a plan to manage those risks. This plan must be submitted to Environment Canterbury ("ECan") every year, or as needed, depending on the state of the farm. ECan uses a grading system when they assess farms. Grade A means the farm is good and meets the requirements set by ECan. If farms get an A grade, ECan will revisit the farms in three years. If farms get a B grade or C grade, ECan will inspect the farms again in two years' time or one-year's time, respectively. However, if a farm receives a D grade, ECan will come again in six months. The worst-case scenario is when farmers get DD grades. ECan will immediately send

somebody from the organisation and talk to farmers about compliance and enforcement issues and possible compliance options.

Information related to the environment that needs to be in the plan includes:

- Crop area (ha), woodlot/trees (ha);
- Amount of water, effluent and fertiliser applied on-farm; and
- Stock numbers and production outputs.

In the interviews, the farmers described this Farm Environment Plan as one of their main tools to address environmental issues. Due to the nature of the dairy industry, environmental issues are unavoidable. All their operations, from soil fertilisation, through growing grass and other crops, to extracting the milk and delivering it to the milk treatment plants, will inevitably impact the environment. Hence, having a Farm Environmental Plan is crucial for them to enable them to carry on with their business in an environmentally sustainable way.

As the FEP is a comprehensive document that includes budgeting, and farmers spend a considerable amount of time making sure they comply with the FEP, they do not currently report beyond the regulatory requirements of the FEP. In the FEP, farmers record non-monetary information related to the environment, but they do not have to disclose monetary information such as the cost of spraying fertiliser on the paddocks and how much they need to spend to install a new irrigation system.

> *…we have to document when we spray it, we just don't then calculate that back to what is the cost of doing it … this is a little bit of work we're doing at the moment. We have a code in our ledger for effluent repairs ... but … you couldn't pull out our financial reports and go, this is the cost of environmental management …* (Farmer 1).

Farmer 2 added: "*…I tend to put almost all the costs into compliance or consent compliance or something like that rather than environmental, even though you could put it in the environmental box"*.

Although farmers have to submit the FEP to show they have identified the environmental risks and to provide actions they will consider to manage them, this report is not fully used. Farmer 3 stated: "*[The] Farm Environment Plan… [is] a document everyone has to have, but a lot of the time, it goes in the drawer*", and Farmer 1 mentioned that:

> *the Farm Environment Plan is the best way of doing things, but the problem is I don't… I'm not a hundred percent convinced it's going to change the behaviour on farm, I think that just actually going to tell us, give us the proof to go. Actually, what we're doing will change behaviour in there. It will highlight a few things that you need to work towards.*

However, Farmers 1 and 4 claimed that the Farm Environment Plan is a helpful way to achieve environmental sustainability when the plan is used effectively by farmers, and if the regulator (ECan) is clear on what information needs to be reported.

Environmental Online Software

As part of the Farm Environment Plan, farmers should also use environmental management online software to calculate, monitor and analyse their farm operations. As there is no specific method to calculate the inputs and outputs in the farm production processes, the calculations and level of comprehensiveness of various software systems differ, depending on the support tools provided in each software package. All the software packages were developed using

frameworks and guidelines from international bodies such as the United Nations and targets set by central government. These software packages are used by the interviewees:

Software Provider	Inputs	Outputs
Fonterra / Agricultural Inventory Model	• Dairy milk production • Cow numbers • Fertiliser inputs	• CO_2 e (effective) / ha, split into CH_4 and N_2O, and the sources of each gas • Emissions intensity (kg CO_2 e / kg MS
OverseerFM®	• Supplementary feed inputs by type, amount • Fertiliser inputs: types, amounts, timing	• Nutrient balance for the farm / block, showing inputs and outputs for a range of nutrients • Greenhouse gas emissions: CO_2 e/ha broken down by CH_4, N_2O, CO_2, and source of each gas • Total farm emissions (CO_2 e) broken down by CH_4, N_2O, CO_2

Using on of these environmental software systems is not compulsory for farmers in New Zealand. All the farmers in my study use Overseer and some farmers also need to utilise the software system of the dairy company they supply milk to, such as the Fonterra software system. One farmer shared the following: "*[Overseer and Fonterra] are basically separate systems…we use the information from Overseer in the FEPs and Fonterra's records. However the FEP and Fonterra require far more data than the Overseer Nutrient budgets"* (Farmer 1).

Creation and Usage of Environment-Related Cost Accounts

Apart from what they put in the FEP and the environmental software packages, the majority of the farmers revealed that they do not currently separate environmental costs from other costs in their internal financial reports and budgets. When asked if she quantifies and documents environmental-related monetary costs, Farmer 1 replied: "*No we don't. …. when I think about*

it, it's really hard because some of it, you could call it an environmental cost, and this is where I think we get tripped up sometimes."

Another farmer said that she identifies direct environment-related costs and creates separate accounts when doing managerial reports. Some of the costs are as below:

> *I've got a recycling code in my accounting system. So, the plastic wrap that goes away, that costs, I put that under recycling cost, then chemical drums, they do charge a small fee for that as well. So, I've put them under there* (Farmer 2).

Although farmers do not currently separate and recognise the environmental monetary costs of their farm, they do "*... have our own kind of reporting systems that we use to record [non-monetary] data … [We have someone we call our] environmental officer or head of environment. Her job is really to collect and collate data around the environment"* (Farmer 4). This non-monetary information is used to report to the management team of the farm. Farmer 4 further stated that: "*... annually, we have to do Overseer reports, so that's where we are looking at joining to more ESG reporting, which is environment, social and governance reporting*."

Although the monetary costs are difficult to quantify and there is a lack of available indicators to monitor environment effects caused by the dairy industry, farmers are very keen to separate environment information from their total annual costs or budgeting. Also, some farmers are already starting to separate these costs from their overhead account. Farmer 2 mentioned: *"our accountant's feedback was, they do have some clients that have created their own cost centres and allocations, and I would probably do something similar."*

From all the interviews, the researcher found that farmers are well informed about how they could quantify the monetary cost of the environment. They identified possible direct and indirect environmental-related costs, as follows:

- The cost of the Environmental Compliance Manager;
- Consultants for some work related to environmental compliance; and
- Actual costs of dealing with Environment Canterbury: when farmers apply to get consents, they pay ECan to monitor them.

Farmers also identified some environmental-related costs that could be allocated to their production processes. Farmer 1 said:

> *… we must be able to determine how long the irrigation system is running and how long to spread the effluent. And then we will be able to work out the cost per hour of the power to spread that effluent, and when we know what our effluent pond bill, we would be able to work out the depreciation* (Farmer 1).

However, because they do not have to report the monetary information on environment-related costs and revenues, they do not practise this allocation although it would be possible to do so. For example, Farmer 4 added: "*And the next step is we go to a full monitoring system where we are getting daily or weekly reports, but at this stage, we're not doing that now. However, we have the capacity to [calculate and monitor the mentioned environment-related costs].*"

In summary, all farmers prepare a Farm Environment Plan and the majority of them use environmental software packages to collect, analyse and report the non-monetary environmental performance of their farm. Although all farmers are able to identify some monetary environment-related costs, only one farmer is actually using environment-related

costs accounts in their accounting reports. In addition, farmers mentioned that the FEP submitted to ECan is not fully utilised. In the next section, the reasons why farmers implemented EMA techniques will be discussed.

4.2.3. Motivating factors for farmers to implement EMA techniques

The researcher identified five reasons why the farmers interviewed apply the EMA techniques: compliance with ECan, economic returns, farm owner support, reputational image and self-gratification. These are discussed next.

Factor 1: Compliance with ECan

The biggest motivation for farmers to practice environmental sustainability is to comply with ECan regulations. In response to international initiatives that seek to reduce environmental impacts, New Zealand created the Ministry for the Environment and under it the Environmental Protection Authority to serve as a national environmental advisor and regulator. ECan is responsible for taking action and developing strategies for Canterbury that match the national environmental objectives. It has also made it compulsory for farmers to submit their Farm Environment Plan, which was discussed in the previous section. The farmers unanimously said that the main motivating factor for implementing the EMA techniques is to comply with ECan. Farmer 1 mentioned:

> *I would say probably 70% is regulation and 30% is because we want to improve, but that sounds bad… In reality, I mean… we know what we're doing is the right thing to do, and we probably would have gotten there anyway, but I think regulation has made you get there faster.*

Although farmers complied with the ECan regulations, they all felt they need some direction on how to meet ECan requirements because they are struggling to complete the FEP and they are quite unsure on how to comply with the regulations. Farmers 4 suggested that they did "*not really"* have support from the regulators:

> *especially not the central government, they couldn't care less to be perfectly honest with you. We've got to [comply with the regulations] and there's no idea of how we should do it. So no. The serious time we start getting support is generally from some of the larger bodies or schemes that we're involved in, like irrigation schemes are very proactive around environmental regulation.*

In addition to the lack of support from the national government, all farmers agreed that they struggle to comply with the ECan regulations. They also mentioned that ECan does not give enough guidance for farmers to comply with their regulations, so farmers do not really understand what they should report in the FEP. Farmer 2 said: "*[training sessions are] not very often, they're more so at the moment because there's so much happened around environment, but there's not that many things that ECan run as such*."

Farmer 2 mentioned that ECan does its part in trying to support farmers to comply with their regulations. However, because ECan also has to meet expectations from the central government, sometimes it is difficult for ECan to take a comprehensive approach that will satisfy all people in the dairy industry. She added:

> *There will be someone from areas [such as the irrigation company and fertiliser company] in the [discussions held], so ECan was also there and they can start to understand more what the farmers are dealing with. Farmers can also start to*

understand what ECan are dealing with because they're getting the pressure from the central government too (Farmer 2).

Although farmers argue that they do not receive enough support from the government, they said they must find ways to ensure that they comply with the environmental law. This is because they must be able to meet several requirements, including from ECan, so that the business can stay afloat. Farmers 1 and 3 revealed:

… you have to follow all the regulations to enable your business to survive, otherwise no one will want to work with you, and you won't be able to sell your goods… you have to be at that standard to sell your goods and then that comes back to profitability, and you won't be profitable unless you do that (Farmer 1).

If we don't get this right, we'll need to shut down… so if farmers want to survive, they need to find ways to work with the landscape and also we've got generations that came through not realising what was happening and assuming that we could just keep making money (Farmer 3).

The farmers also recounted events when ECan imposed sanctions for failure to satisfy the unmet regulations. Farmer 2 gave a real example of a situation where a farmer has not complied with the ECan regulations. She said:

… [farmers] would just have to go out of business because it has a flow on effect. I met this one girl that does an agricultural business paper as well and she was in class with me… she is milking for someone at the moment and the owner of the farm did something that he was not supposed to. So, he's sort of being blacklisted a bit with ECan and he's

very staunch against ECan. Eventually literally … worst case scenario, you would not be able to run that farm anymore.

Farmers elaborated on how they make use of different organisations in the industry to ensure that they are on the right track with environmental policies. One of the initiatives that farmers take to ensure they comply is actively engaging with dairy industry bodies such as DairyNZ. Farmers pay a levy to these organisations to conduct research and development for better farming practices. These industry bodies will also act as advocates for farmers with central and regional government and provide various activities to update farmers on policy matters: "*And then DairyNZ, they are a really good resource… because usually they have seminars and things like that*" (Farmer 2).

Also, one farmer mentioned that he seeks advice from Ravensdown, an agricultural fertiliser cooperative that helps farmers reduce environmental impacts. This company also helps farmers in various ways such as by ensuring they obtain their consents from ECan, and consults with farmers with regard to both the FEP and the environment software packages. Farmer 4 claimed: "*We do rely on Ravensdown a bit for environmental reporting. So, if we have any real challenges that we can't overcome internally, then we would turn to Ravensdown for their support*".

Apart from support from large organisations, farmers also found that they learned a lot from other farmers' experiences. They did not just learn how to comply with the ECan regulations, but they also learned to reduce ecological impacts on their farm. Farmer 2 stated: "… *we have a pretty good rapport with all our neighbours. [Farmers] talk to each other and discuss how we could improve our farm practices to meet the existing policies and regulations"*. She also

highlighted the role of a discussion group formed by farmers to educate themselves, where farmers in "*[the] area that have got under 500 cows get together every two or three months and talk about how they are doing… sometimes there's one farm that might be trialling a new crop or something like that and they talk about how that worked for them or how they're managing their waterways or something like that*" (Farmer 2).

A lot of farms in New Zealand are family businesses, which the owners manage on a day-to-day basis. Although dairy farmers have a busy period, usually with calving in mid-October, their work is continuous, daily, and cannot be postponed. As a result, it is very hard for them to keep up with the changes in regulations. However, with support from a lot of people in the industry, dairy farmers can learn and adapt the new knowledge to meet the legal requirements.

Although compliance with ECan regulations is the main factor influencing farmers' reporting and practices, a few minor factors that motivate farmers were mentioned, discussed briefly below.

Factor 2: Economic returns

As dairy farming may provide good opportunities to earn money, and because economic return is important for farmers, farmers stated that economic returns drive them to implement EMA techniques. As confirmed by one of the farmers: "*… especially in the last week [February 2021], the price of milk and everything else is just doing so well"* (Farmer 2).

Factor 3: Farm owner support

One farmer who manages a farm but is not the farm owner reported that he adopts EMA techniques due to the support he receives from the owner of the farm when seeking permissions

and licensing. This means that the farmer is motivated to observe EMA techniques when the owner is actively involved especially when the farmers conduct meetings that need the owner's attention. The farmer also finds it motivational to adopt EMA techniques when the farm owner provides resources that ensure environmental practices are executed. He said: "*[The farm owner]'s a bit of a capitalist at heart, but then he's also got this large environmental heart as well*" (Farmer 4).

Factor 4: Reputational motivation

Farmers reported that maintaining the business reputation is another factor motivating them to implement EMA techniques. From their perspective, maintaining business reputation means that every business must maintain a good image in the eyes of the public, which includes the customers and the staff. It may take a long time to build a good reputation but, in the end, it will be rewarding. For example, Farmer 1 said:

> *… the most valuable thing you own is your reputation. And it's the only thing you take to your grave and our biggest challenge is our reputation, it's our name on the gate and so then when we've got contract milkers and they employ staff… if you do something wrong it's our name that's going to be in the paper. So, we always want to do the right thing with the environment because … a lot of what we do is about reputation … we've worked hard to build a reputation – [it's] hard to build and maintain it, to build a good brand.*

Factor 5: Self-gratification

The researcher did not specifically asked about internal motivations but one farmer mentioned about obtaining internal self-satisfaction when she invested some effort towards environmental conservation by implementing EMA techniques. She knows that implementing environmental

management techniques might help in reducing the environmental impacts of dairying. She shared the following:

> *For some people, it's probably more external. But for me it is a little bit internal as well … I don't know if you've heard of Trish Rankin. She was Dairy Woman of the year. She has done this huge environmental campaign which is part of the reason why she got the award. She is doing a lot of other things around recycling … she made lampshades out of old milk cups … When you come across people like that, you know, they inspire people … in the industry to do this sort of thing. And even this thing that I went to the other day, the young couple do a lot of the planting and stuff on the farm, over and above the expectations of the farm owner. So, it is helpful … to see all of the people that are doing it, things that are possible* (Farmer 2).

In summary, this section explored the factors encouraging the adoption of EMA techniques. Although abiding with regulations from ECan is the main reason for applying EMA techniques, economic benefits, reputational motivation, farm owner support, and self-gratification are also contributors to farmers' desire to protect the environment and report environmental-related information.

4.2.4. Barriers to using EMA techniques

Although legislation makes farmers adopt EMA practices, it was found that farmers experience five barriers in complying with the standards. The main barrier that hinders the adoption of EMA techniques among farmers is related to compliance with regulations introduced either by the national government or ECan. These are discussed below under the headings:

- Environmental proposals lacking clear directives and guidance
- The behaviour of the regulators

- A lack of extrinsic motivation
- Impractical and unworkable environmental regulations
- High compliance costs

Four other barriers to farmers implementing EMA techniques are then briefly described:

- Difficulty quantifying benefits of EMA
- A short term focus
- Problems with information collected
- Organisational siloing

These nine barriers are discussed below.

Barrier 1: Environmental proposals lacking clear directives and guidance

One of the biggest barrier for farmers in adopting the EMA techniques required by the regulators is that actions are said to be urgent but the steps that farmers need to go through to comply are not clearly communicated to farmers. For instance, the Government proposed the National Policy Statement for Freshwater Management in 2019, which will require all councils to have new freshwater management plans in place by 2025. The freshwater management plans required farmers to comply within six months. Farmer 1 said: We *"oppose that farmers would have six months to comply with new standards after regulations come into effect."* Farmers opposed this because policies around the environment keep changing and the Government does not provide clear information. To move at the same pace as the Government's expectation but with vague information is difficult to farmers and *"six months is too short of a time to allow farmers to make farm system changes. … To keep up with the policies and regulations is a real challenge"* (Farmer 1).

Farmers stated that emails are an inappropriate method to convey information about aspects that require urgent action as farmers often do not read them as they are too busy. Hence, farmers do not get the right information at the right time. One farmer mentioned: *"Most farmers do not read emails. I don't read emails"* (Farmer 5).

In addition to the fct that farmers do not read emails, they also stated that they cannot comprehend all the details in the environmental policies. Hence, it takes time for them to read and to understand the content of the policies. One farmer added:

> *I've been in that position in my career where … we just don't understand what is in the policy. So, when someone gives farmers a 600-page document and says, this is a new law … I'll be surprised if they even read the title* (Farmer 4).

As mentioned in the previous section, farmers claimed a lack of support from the regulators that impose various policies. For instance, Farmer 3 claimed that: *"[The regulators] do a bit … the only ones that would probably give you more support is through Fonterra and the Ministry of Primary Industries"* (Farmer 2).

In turn, farmers felt overburdened and confused about what to do to meet policy goals, making it difficult for them to implement the EMA techniques. Although they demonstrated that they have environmental concerns at heart, it is the complexity of policies without support and guidance that makes it difficult for farmers to apply EMA techniques. For example, the views of two farmers on this are shown below:

> *[Farmers] get overwhelmed … they feel like they met the last target but now need to change … so those who really want to get it right [are] very enthusiastic … then when*

it gets harder and harder and no support is given, and people still need to do it, some get through it, some won't (Farmer 3)

I can't see any of those three levels of authority (i.e., central, regional, district) have an actual common vision. Actually, most farmers are green at heart. They actually want to do the right thing. However, at the moment, [there's] no support from [the central government, regional council and district council] (Farmer 4).

Barrier 2: The behaviour of the regulators

The farmers interviewed also become demotivated toward the implementation of sustainable development practices because of the attitude and lack of drive of the regulators. They argued that the regulators simply pass on the environmental policies to farmers and use coercive methods such as threats to get them to comply with the rules. Consequently, farmers feel that this method does not help regulators enforce compliance. As an example, Farmer 1 reported:

[There is] this one individual in environmental regulation at the moment … [that] has a bad attitude... to farmers … "I'll get you one day!" Well, that kind of behaviour doesn't build trust and it doesn't build [the feeling], we're all in this together. The New Zealand economy, and the wellbeing of citizens relies heavily on the agriculture industry. So just coming out and saying, "… if you complain and if you keep complaining, I'll make you pay more" … well, that kind of attitude doesn't build confidence, … trust or anything. So, first and foremost, I think that type of behaviour just has to be outlawed because that's not helping anyone (Farmer 4).

In addition to the coercive method used by the regulators, more than half of the farmers also said that the regulators do not maximise the communication methods that they could use to

convey the information about environmental policies that they put in place. As a result, farmers found it is a struggle for them to comply. Farmers claimed:

> *people at the top [i.e., regulators] that do not really know what rules and policies are going to affect everyone* (Farmer 3).

> *It's almost a top-down approach. And you know, any businessman can tell you that a top-down approach will have almost no buy-in at a low level or any level.* (Farmer 4).

Barrier 3: A lack of extrinsic motivation

Another barrier to implementing the EMA techniques is the lack of extrinsic motivation. Because the operational expenses on farms are already high without considering environmental management, farmers said they need some extrinsic motivation to ensure they are willing to take actions to obey environmental laws. One farmer talked about the lack of extrinsic motivation for accounting for environmental costs and revenues:

> *...As you look at a lot of the awards …that we have, the Balanced Farm Environmental Award is probably one to them. Lot of awards are around how much money they can make. And that's what the industry has championed. And to a degree, that's what … New Zealanders champion. So, I think [we need] a bit of a pivot change in the way that we promote farming going forward* (Farmer 4).

Barrier 4: Impractical and unworkable environmental regulations

Furthermore, farmers found that it takes a lot of effort for them to implement the EMA techniques because the regulations themselves are impractical. As a result, farmers believe that it is not worth implementing them. For instance, farmers shared some of the environment-related documents they have submitted to the relevant people in the industry, such as ECan,

the central Government, and the milk company. In one of the documents, one farmer strongly opposed a new regulation proposal for "tight restrictions on land use changes – that limits opportunities and [is] not supported by scientific evidence" (Farmer 1). Farmer 1 also mentioned:

> *Everyone knows we want fresh water, there's no debate about that … one hundred percent we want to do the right thing, but it has to be practical and some of the rules that come out with it [are] just not practical*. (Farmer 1).

Several of the other farmers also raised the same issue about the impracticality of the regulations:

> *They're not practical people … through their education, they've sat at a desk and go with data. And they speak their language and their words, that mean whatever, but they're not practical with it. It's like they might as well be from a different planet, speaking a different language and come out with their ideas when they don't have the practical skills* (Farmer 5).

> *Sometimes there are regulations applied that are the same for everyone, but farms are so different to each other …for example, the amount of nitrogen that goes into the soil … different soil types will be different … there can be a feeling that they are making laws without thinking how to benefit everyone and it might be easy for this guy and hard for this guy (easy vs hard means expensive)* (Farmer 3).

> *…. about the nitrogen cap, so, [it's like having one speed limit where] it does not matter whether you are driving out in front of the school or you're on the open road, it's 60*

km/h… that's what the 190kg N/ha's saying – it doesn't matter what soil type you're on (Farmer 1).

At the end of the day, I think there's a lot of people trying to get involved in farming and to regulate it, but [they] do not know what they are doing. And they [are] just making it difficult. This is just ridiculous (Farmer 5).

Barrier 5: High compliance costs

The high compliance cost is also one of the key barrier for some farmers in taking care of the environment. The cost in terms of money and time is considered to be too much of a burden for them, as small businesses. Farmers claimed that:

Our Environmental Compliance and Enhancement Manager has been there about 18 months and she hasn't got onto enhancement yet because compliance is such a massive job… you spend all your time trying to comply with new rules, keep up with new rules, till you cannot get to spend some time actually making the environment better … It's so frustrating. I … heard somebody say once, "the fastest way to slow down progress is to regulate it because you spend all your time meeting regulation rather than just getting on and doing what you do."

Barrier 6: Difficulty quantifying benefits of EMA

In addition, farmers claimed that because they cannot calculate the benefits they receive from implementing the EMA techniques in monetary terms, it is challenging for them to adopt them. The central government, as well as ECan, set many objectives and targets to minimise environmental impacts. For example, in the Farm Environment Plan, farmers need to disclose the ecological effect of their farm operations, such as their irrigation system, nutrient loss

mitigation measures, soil management to minimise the movement of sediment and phosphorus, and the water used in their dairy shed. Providing this information is a cost for farmers as they have to spend money and time on completing the FEP. Still, farmers are not aware of any *"benefits that [farmers] can actually see because they have to pay a lot"* (Farmer 4) nor what are the best forms of environmentally sustainable practices. Two farmers said:

> *If you're going to look at the costs, you need to look at the benefits (i.e., revenue), which is sometimes harder to quantify* (Farmer 1).

> *When you look at it at a macro level, we're getting forced into making long-term decisions on short-term data. For example, they are saying, "Look, we're going to have to change our model Y to model X, but we've got no long-term validation of whether or not that's going to be sustainable and beneficial in the future." So, there's certainly a lack in the market at the moment around linking those areas* (Farmer 4).

Farmers also claimed that it is confusing for them to comprehend some of the definitions provided in the environmental policies. For example, in management accounting, budgeting means a plan that specifies expenses and revenues that a company expects in the future. This definition is aligned with the farmers' understanding of what is budgeting. However, when ECan ask farmers to do a nutrient budget, it demands that farmers do a budget looking at past performance instead of taking a future view. Farmer 1 mentioned:

> *the biggest problem with nutrient budgeting …is, it's called the nutrient budget because it's a model that's based on the future, but it's actually looking backwards, whereas accountants think of budgets as future oriented. So, you get to the end of the season, and you put in all your last financial year or your physical data for the last year and*

then nutrient budget for the last year, whereas what we actually want is a forward looking nutrient budget (Farmer 1).

This prevents the farm managers from providing information for planning and performance measurement, which they could use for decision making. Farmers claimed that the "*definitions need to be clearer to allow people who will be affected to make a decision and clearly understand how their farming operation will be affected*" (Farmer 1), whereas more than half of the farmers interviewed found it challenging for them to adopt the EMA techniques required.

Farmers also do not quantify most of their environmental costs because they do not know how to calculate the costs, and they are unsure which costs should be classified as environment-related costs and which costs can be put in the overhead account. As a result, they tend to ignore any calculations that are voluntary, most of which are monetary environmental costs. Farmers revealed:

So, it's getting hard for people to keep up just with the complexity even for those who want to change. Also, when the government brought in a new regulation last year about a water quality target, we are yet still going to hear if it's going to be measured and who's going to do that. Is it going be audited? (Farmer 3).

We don't [calculate and make allocations to environmental costs]. We did a submission on Freshwater recently. I think I did a rough tally up in there, on our costs. When I think about it, it is really hard because some of it, you could call it an environmental cost, and this is where I think we get tripped up sometimes (Farmer 1).

Barrier 7: A short-term focus

Most of the farmers still think that their decision making has something to do with making a profit. Hence, they focus on ways to increase productivity and profit, which is short-term sustainability, instead of thinking about the benefits that EMA techniques implementation would bring in the future. Farmers stated:

> *If you can't make a dollar, there's no point even trying to think about [being] environmentally sustainable. I think that's where things are at in the world at the moment … and I think that's where some of the conflict comes from … ECan, their focus is on the environmental* (Farmer 2).

> *… you've got to be financially sustainable first* (Farmer 3).

> *I've always believed that you can never be environmentally sustainable if you're not profitable. And … there needs to be a level of commercial in your business* (Farmer 4).

The majority of the farmers are aware that it is crucial to consider other aspects of sustainability, i.e., the environmental, economic, and social, as they are all linked together. However, financial survival is pre-eminent. : The interviewees criticised other farmers for not considering the environment:

> *Well, at the end of the day it's more … sustainability as a whole thing* (Farmer 2).

> *… it can be quite hard on other people when you just don't care about the environment, don't care about the social work. It's just been a pretty mundane kind of job* (Farmer 4).

> *People only care about production, but the cost of production as profit margin might not be as big as they think, so it is not worth it. But we have discovered that we can dial back production a bit as it is more efficient while being more environmentally sustainable* (Farmer 3).

Barrier 8: Problems with information collected

Another barrier for farmers in implementing EMA techniques are problems that they discovered related to the environmental information which they have collected. The first problem is the reliability of the information collected. For instance, some farmers do not know how to use the equipment provided to record data on farms. Consequently, the data gathered are not accurate, which is a problem when the farm managers use those data to monitor environment-related costs and to plan for their organisation. One farmer said:

> *Farmers have to be really careful in recording what goes on and what goes off, where they go, is it into each paddock? They need to have someone to record it accurately. If [we are] being audited, we often see a difference between what a truck driver says and what is actually charge on the bill. It is a challenge for farmers* (Farmer 3).

Secondly, another farmer mentioned the ineffectiveness of information collected by farmers. Once farmers collected the data, the information is stored in separate folders, depending on who are the users of the information. Consequently, they need to spend time dealing with the data collected instead of focusing on the farm's operation. Farmer 4 stated:

> *I think we could collate [the information] better, and that's a limiting factor. The collation of data is limited. I think we don't have enough software in New Zealand around the collation of data. However, collection is not a problem* (Farmer 4).

With regard to the environment software packages mentioned in the previous section, Farmers 3 and 4 pointed out frustrations with the existing software systems and the users of the system:

> *One area that absolutely frustrates me as a farmer is that there are like 15 different platforms that I have to go onto and get the information. It would be great if you just have one dashboard and you click on environment and that pulls out all your environmental related data, click on finance, pulls your finance data then on social, it pulls all those data out, click on whatever ...we don't even have it for any of those individual silos* (Farmer 4).

> *There is a lot of inefficiency in recording of farm data. [There] seems to be a need for a centralised system….for example, the data from Overseer can be used for everyone. It is wasting a lot of time and farmers' patience. For example, Fonterra has their own system, Ecan too, and some are redundant…* (Farmer 3).

Barrier 9: Organisational siloing

One farmer talked about how the individual farm managers tend to monopolise the information collected instead of sharing it and collaborating with other farmer managers. This has led to struggles in making decisions during top management meetings. He also found it difficult to ensure that all managers have the same objective (i.e., making the environment within the dairy industry better). As a result, it is hard to execute the EMA techniques that will positively impact environmental sustainability. He mentioned:

> *So, you've got to bring kind of three heads to the game to try and solve the challenges. And that's awfully hard because someone that's good at finance, doesn't understand the environment. Someone who's great at environment doesn't necessarily understand*

operations. And it's very hard to find someone that's very good at all these three (Farmer 4).

This section has discussed the barriers to using EMA techniques. These points of concern need to be seriously addressed if the Government intends to improve environmentally sustainable practices in New Zealand.

4.2.5. Improving the identification and management of environmental costs

Given the multiple barriers to farmers using EMA techniques, the famers interviewed made several suggestions of how to improve the identification of environmental costs, and how to ensure that farmers consider environmental and other related costs information when making decisions. These suggestions are presented below.

Suggestion 1: Improve environment standards and regulations

The first way to improve the identification of environmental costs and revenues is for the regulators to rethink environmental impact mitigation strategies so that farmers will be able to implement them. Environmental policies need to enable the identification, collection, measurement, and reporting of environmental-related costs. Farmer 1 said:

> *The biggest challenge is getting regulators to understand what actually happens on farm. And I think, the Farm Environment Plans are the best way of [reducing the environmental impact on farms], but the problem is … I'm not one hundred percent convinced they're going to change behaviour on farm* (Farmer 1).

One way regulators could address this is by producing a comprehensive policy that not only focuses on the dairy industry, but is also relevant for other environmentally sensitive industries

such as the horticulture industry. Then, dairy farmers will feel that they are not the only contributors to the environmental impact and may be more willing to work together with other industries to improve the environmental sustainability of New Zealand. Farmer 3 claimed that:

> *… it is a job for people at the top to think about it. Also, everyone knows that no regulation fits all. For example, the nitrogen limit (last year) … that's just targeting the dairy industry in particular, and it will have an effect to reduce nitrogen by doing that. However, a lot of horticulture businesses are doing the same thing but not being targeted because the public's not aware about that* (Farmer 3).

Given the perception that environmental regulations are impractical and unworkable, one farmer suggested that regulators should prove to farmers that their requirements in the policy are feasible so that farmers are willing to abide by their environmental regulations. He said: "*They [the regulators] need to show people what's possible. This has always be an issue because what is possible here might not be for others, but if they can provide one solution for all, it would be good"* (Farmer 3).

Suggestion 2: Consistent and simple software packages

The second way to improve the identification and management of environmental costs and information is by having a centralised software package so that farmers do not have to spend a lot of time to input and pull out the information. One of the farmers said:

> *Sometimes you just do lots of paperwork for the sake of doing paperwork. It seems like it. But I think once a system gets developed, this will change. So as technology gets better and cheaper, complying is getting easier* (Farmer 1).

Farmers are familiar with accounting systems, such as XERO, MYOB and even ERP systems. Hence, they suggested that if the identification and collection of the environmental costs could be integrated within these systems, this would help farmers, in terms of money and time, to upload the information into the accounting system and to measure their current performance environmentally. They shared the following:

> *Something like the ERP or within the accounting system will be helpful to accurately capture environmental information. … because obviously we have our cost structure, and we want to code things where we do, and you don't want to just chuck everything into environment. I think it is just somehow having a system where you can identify the costs and the ledger and pull a report on there* (Farmer 1).

> *I think the dashboard is one of the first steps. My favourite catchphrase in our business is "what gets measured, gets managed." And if I want any type of performance on my farm to improve, I just start measuring the results and I get instant performance from my teams because no one wants to be the poor performer or no one wants to be second – that is just in their nature, so, I believe measurement is key in our industry. We need to get better at measuring*. (Farmer 4).

> *We need a system that links operations, accounting, financial, and environmental together into one system… it's still lacking in my view but still could be worked on* (Farmer 4).

Suggestion 3: Improve communication

As the dairy industry is complex, communication needs to be adequate to convey all environmental information and objectives clearly and accurately. Everyone in the industry need

to understand the same information to ensure farmers follow what is intended. Environmental information needs to circulate within the dairy industry, so that different industry bodies do not have to ask for the same information from farmers, which consumes a lot of farmers' time. Farmer 1 shared:

> *Synergies between all these different compliance and reports [demands] are needed so we do not have to produce them so many times. For example, take a dairy farm: an inspector comes from Fonterra, speaks for 2 hours in your shed making sure you're doing what you need to do to meet your terms and supply. Then you have the environmental consents. So, ECan come onto your farm and monitor what you're doing. And then you potentially could have a work site [visit] … the Department of Labour comes and makes sure your employment records are correct, … and the Ministry for Primary Industries (MPI) come and ensure your animal health. All of those are the pillars under Fonterra. What would be the ultimate and reduce compliance costs and headaches for farmers is for one auditor to come in ... an external auditor doing everything – because there is a lot of the stuff you need to show them, … do it under a single hat and then [they] give you a certificate or whatever, that you can send to MPI, ECan and other people in the industry* (Farmer 1).

Suggestion 4: Show the benefits of factoring in environmental costs

The prior literature on the triple bottom line and the findings in the previous sections have shown that profit is the main focus of farming. Farmers recommended that regulators and policymakers consider the financial impact when designing environmental policies. If farmers could see the financial benefits of calculating environmental costs in terms of cost savings, they would be likely to comply. For instance, farmers said:

I think when you can see a financial benefit of everything we do environmentally, then there will be no argument. You'll do it because there will be a benefit (Farmer 1).

… the economical return for your investment, [should be] the minimum requirements to keep you moving forward (Farmer 4).

I would love to see a system … when there's regulation [that says]… here are five options from an environmental perspective and here's the capital and financial requirements and outlays, and here are the financial benefits that are expected. (Farmer 4).

Suggestion 5: Farmers need to change their mindsets

The final way to improve the identification of environmental costs and information is by changing farmers' mindsets. Psychologically, accepting what one does not like and coping with problems may be the most difficult processes of life (Wilner, 2021). It is the same in dairy farming. Ensuring changes are executed successfully needs cooperation from every person in the industry. All participants admitted that although they do not always agree with the policies and regulations imposed by the regulators and the milk companies, they need to overcome the problems and deal with them for a better future. Farmer 4 stressed that:

I definitely think that we can do things better and we had our chance to do it without regulation, but we didn't do it. I feel that some of the limits are potentially aspirational. And I don't think technology is going to be the main solution … a lot of people think technology will take away our problems. Well, I think technology certainly will help us, and then innovation certainly will help us, but we need a change in mindset at the farm level and I would invite all farmers to start looking to themselves as food producers …

We have to evolve, and we have to hugely change for the better future of farming.

In conclusion, the interviews with farmers in this section provided an interesting insight into farmers' perceptions of the negative environmental impacts of dairying. Farmers view environmental sustainability in dairying as being able to supply food to people while continuing to maintain or improve the environmental impacts so that future generations can still enjoy nature as we do today. Farmers do use some EMA techniques, but mainly using non-monetary measures. Compliance with ECan and the Government is the main motivation for using EMA techniques. Barriers to EMA usage include lack of clear directives and guidance and perception that the regulator is imposing impractical and unworkable regulations which come with high compliance costs. Farmers suggested that they will feel more confident in implementing the EMA techniques and willing to make the changes for a better future of dairy farming if the communication and the environment standards and regulations improved, there are consistent and simple software packages and the benefits of factoring in environmental costs are tangible. Interviewees also suggest that farmers need to change their mindsets to improve identification and management of environmental costs.

4.3 Dairy Company Interviews

Interviews were conducted with the environment managers of two dairy companies in New Zealand. Both of them are the main contacts between the dairy companies and the farmers but also have responsibility for ensuring the dairy company meets all its environmental regulatory obligations. The findings from these two interviews are categorised similarly to the farmers' interviews: the dairy company representatives' perceptions of the impacts of dairying on the environment, whether the dairy companies use any EMA techniques, the benefits of using

EMA, what motivates farmers or dairy companies to focus on reducing environmental impacts, barriers to using EMA techniques, and suggestions for improvements.

4.3.1. Dairy companies' perceptions of impacts of dairying on the environment

As dairy companies are part of the supply chain getting dairy products to consumers, their awareness of the impacts of their companies on the envinroment and their efforts for environmental conservancy are important. The dairy company interviewees are familiar with the obvious impacts of dairying: the emission of greenhouse gases, and soil, water and nutrient pollution . Details of these pollutions are described below.

Emission of greenhouse gases

The dairy company participants identified greenhouse gas emissions as the main impact of dairying on the environment. Although dairy farms contribute a large amount of greenhouse gases emissions, dairy factories are also responsible for emissions. The interviewee from Dairy Co.1 reported that the company has an advisory team on environmental management that provides support on issues relating to the environment in critical areas such as greenhouse gas emissions. The participant also stated that the company has developed a greenhouse gas inventory to help in calculating emissions from farms. The participant shared the following:

> *When we made our greenhouse gas inventory, we calculated the greenhouse gas emissions for the company and we also calculated the emissions from our farms. We realised that 81% of our total greenhouse gas emissions come from the farms … it doesn't mean that manufacturing should not [take any responsibility], but it really shows that there was quite a big chunk that comes from [the farms]* (Dairy Co.1).

Furthermore, participants pointed out that, due to the increase in demand for milk products, dairy farming has grown and therefore the emission of greenhouse gases from dairy farming has continued to increase every year. Hence, when considering farmers' eligibility to supply milk to their companies, the company looks at the farm's management of greenhouse gas emissions as one of the criteria they look at. Participant Dairy Co.2 also said that "*… the primary focus over the next few years is greenhouse gases …we need to change"* (Dairy Co.2).

Soil, water and nutrient pollution

Participants also mentioned that dairying has led to soil and water pollution caused by on-farm and off-farm wastes such as plastic, and chemicals from fertiliser as well as products dairy companies use at their plant to clean the factory and disinfect the tanks. The media have been questioning whether dairying might be a factor in bowel cancer in New Zealand because of high level of nitrates in drinking water (MacLean, 2021). As cow urine is the main contributor to increased nitrate levels, one interviewee claimed that "*a more sustainable way of farming is pretty much the only option we have got because of the current state of water and soil"* (Dairy Co.1).

Excessive use of nitrogen and phosphorus fertilisers in dairying as well as cows' urine have hindered nutrient cycles. This is because chemicals in the soil have prevented the usage, movement and recycling of nutrients in the environment. One participant said: "*Nitrogen is very much, …linked to nitrogen fertiliser, but also from urine …cow urine. You can't do much about it but you can find ways of managing this"* (Dairy Co.1).

One way the New Zealand government is trying to reduce nutrient pollution is by limiting the utilisation of synthetic fertiliser. The participants mentioned: "*Some of the biggest challenges*

in the industry at the moment are under the Freshwater Programme announced six months ago, where farmers can't put in nitrogen more than 190kg N/ha/year" (Dairy Co.2). However, both dairy company participants stated that there are no methods available to quantify the value of the initiatives in dollars.

Both participants perceive higher effects of dairying on environmental sustainability than farmers and they are concerned about the low environmental quality in New Zealand. With their background in environmental management, both interviewees believe that they have an active role to educate farmers and increase farmers' perceptions and knowledge about environmental sustainability, so that farmers can improve their environmental management techniques and thus reduce the impact of dairying on the environment.

4.3.2. EMA techniques used

This section will focus on EMA that the dairy companies uses. One dairy company does sustainability budgeting that reports non-monetary environmental information, and both submit reports to ECan on their environmental performance. The non-accounting practices that both companies apply comprise reusing and recycling wastes, and educating farmers on environmental rules. These practices will be discussed below.

Technique 1: Sustainability Budget

The interviewee from Dairy Co.1 has substantial knowledge on environmental sustainability, so she is actively involved in preparing a sustainability budget for the company. She stated: "*We have a predetermined budget for the year. So we include the activities that we like to do in that year and …we monitor the progress over time and [compare it with] the budget because that's a … standard across the company.*"

Technique 2: Environmental reports

To prepare the environmental reports to ECan, both dairy companies have to evaluate their environmental performance and submit measures of their greenhouse gas emissions, their waste management, and the amount of chemicals used at their plants. They have to report monthly to ECan on environmental compliance and then submit an annual summary of all the monthly reports. Dairy Co.2 said:

> *we monitor our greenhouse gas emissions, wastes, chemical usage, and we [give a] full report to ECan once a year. But also, we do [changes that will possibly have impacts on the environment] during the year … and we also have to report the results to ECan ... Some [of the changes] we report on a monthly basis, some [of them] we report in three months, some it's once a year, and it's all summarised in a large annual report.*

Data reported include, "… *how much nitrogen we're using, how much fertiliser used and water use management"* (Dairy Co.2). However, the manager of Dairy Co.2 claimed that while the company knows the costs from a financial accounting point of view, he is not currently allocating those costs to particular products or processes. For example, he broke down the cost of recycling and managing the flow of wastes, but he mentioned that they are not doing any cost centre accounting or cost attribution accounting. Dairy Co.2 said: "*I can tell you our waste, how much in total it costs. I can tell you how much the cost of landfill is, how much the cost of carbon, how much the cost of plastic, but we are not doing it per product."*

In addition to the report that dairy companies need to send to ECan, the interviewee from Dairy Co.1 mentioned that her company produces an annual Greenhouse Gas Inventory Report to assess their current environmental performance. She also stated that her company has its own

environmental targets that align with the national and international environmental objectives. For example, the company is targeting zero carbon – not only off-farm carbon emissions, but also on-farm carbon emissions – and the company is also trying to substitute coal with renewable energy in their plants. Dairy Co.1 reports on the sources of greenhouse gases, such as from coal, diesel and on-farm emissions, and calculates the total emissions of each source. From this report, the company can evaluate their current performance and make plans to improve the environmental best practice. Although the other dairy company does not produce sustainability reports, it is planning to report the environmental performance to the public in two or three years' time. He said:

> *We do not produce any external environmental reports at the moment. We know other companies are starting to do that. We've thought about it at some stage and we are planning to produce [external environmental reports] in the next couple of years or three years. But we still need to look at what we can do [to prepare for the reporting], what we could report in the environmental report, which would be of interest to anybody and would help them to make decisions in the future.*

Technique 3: Educate farmers on environmental rules

The third technique to manage the impact on the environment undertaken by the dairy companies is to educate farmers on current environmental rules and regulators' expectations of the environment impacts of dairying. The dairy company participants stated that their companies manage environmental issues by adherence to regulations and farmers are also obliged to comply. Both companies supply knowledge to farmers on meeting the regulatory requirements on environmental management as the education has "knock-on effects" on the dairy companies' compliance too. There are systems in place for ensuring new rules are passed

on to farmers for compliance. Furthermore, farmers are provided with information to let them know where they stand with suppliers. Participants shared the following:

> *So, we actually expand and improve [our standards for farmers] to keep up all the time with the regulations …* (Dairy Co.1).

> *We're doing the work with farmers to make sure that they meet all of the regulatory requirements around the environment, and we're making sure that they are in a good place to implement further things. So when new policies come out of government, we know it will be a whole lot more stuff, but we are prepared to do so* (Dairy Co.2).

Technique 4: Waste management

The dairy company participants also stated that they managed the environment by recycling and reuse of waste. For example, the interviewee from Dairy Co.1 shared: "*So we have general waste as well as recyclable waste. We actually have quite a number of people in our team who help us manage the waste on site and they have to sort what is recyclable and what not.*"

One of the main wastes is the water usage when making milk powder. One of the ways to reduce water usage is by reusing water from the condensation process. This wastewater is drained into the ground or stored in an underground tank and will be reused for future consumption. The interviewee from Dairy Co.2 stated: "*we take the wastewater out of the ground. We use that water to wash the plant etc., and the treated water, we put … back on the land. So, currently we recycle the water we're putting in at the moment, from the chemical reuse plant.*"

4.3.3. Benefits of implementing EMA techniques

Identifying, collecting, and reporting environmental costs is beneficial for the dairy companies, because it allows them to monitor their gas emissions and to manage their environmental costs.

Benefit 1: EMA helps dairy companies monitor gas emissions

An EMA approach and the information produced is useful for dairy companies in prioritising projects and investing in more efficient projects. Dairy Co.1 said that information collection helped them "*to understand the importance of each category as well as how [we're] tracking and therefore that informs the types of projects [we] can do to improve it. And then the percentage of reduction that these projects are likely to bring in will be clearer*."

Benefit 2: EMA helps dairy companies manage environmental costs

The dairy company participants reported that information collected help them in identifying areas where costs could be reduced. For instance, Dairy Co. 2 said that the report his company prepared helps him to find alternatives so they can reduce the energy usage of the company. He said: "*Part of the initiatives I talked about [is] for reducing energy costs, reducing coal used in the plant, which [leads to improvement in the] energy budget.*"

Also, the Dairy Co.1 interviewee mentioned that the Greenhouse Gas Inventory Report her company is currently preparing assists her not only to assess investment projects, but also to assess the company's as well as the farmers' environmental achievements. This report also allows her team to work with farmers to try to reduce gas emissions. She added:

> *We've got two climate change targets. One of them is on-farms. So, it's to reduce 35% of greenhouse gas emissions per kilogram. So having the data reporting on it helps us understand what's going on and it's also very helpful to understand the breakdown of the*

greenhouse gas emissions (carbon dioxide, nitrogen, etc.) and the responses that we bring for each gas will be different.

4.3.4. Motivations to reduce environmental impacts of dairying

It is in the best interests of people in the dairy industry to protect the environment because a clean and healthy environment not only reduces the environmental impact, but it can also enhance the productivity of the farms, which consequently increases farms' profit. There are four motivations for the focus of dairy company interviewees on reducing environmental impacts of dairying: compliance with environmental regulations, maximising productivity on farms, reducing environmental costs and attracting people to join the company.

Factor 1: Compliance with environmental regulations

The dairy company interviewees reported that they focus on reducing the environmental impacts because they wanted to comply with statutory regulations regionally and nationally. Also, they wanted to be part of the change as the whole dairy industry moves towards environmental management compliance. One interviewee said:

> *The industry as a whole is moving that way. I sit in [meetings] with dairy companies, processing industries, industry groups … and DairyNZ are also working with the Government to sort of steer the dairy industry in one direction, [which is to reduce the environmental impacts]* (Dairy Co.2).

Factor 2: Maximising productivity on farms

Also, dairy companies are focusing on environmental management because farmers are their principal suppliers. Without farmers supplying their milk, the companies cannot make any dairy products. If farmers focus on improving soil quality, reducing pollution and reducing or

eliminating damage to the landscape, their paddocks will produce more grass, and the milk productivity will increase. As a result, dairy companies will receive more milk from farmers. As one interviewee said: "*Our farmers will be more resilient because they will be more productive as they have eroded their soil less and this is their chance to be in a better shape, because their grass will be growing better"* (Dairy Co.1).

Factor 3: Reduce environmental costs

Dairy companies are focusing on environmental management techniques to help farmers make more profit. When there is low usage of chemicals and fertilisers, farmers will have reduced the cost of buying such inputs, thus increasing profit margin.

> *So the motivation is … to benefit farmers from these investments [taking into account environmental costs]…they'll have less cost, they will be more profitable because they'll have learned how to improve on irrigation, use less nitrogen fertilisers. So, their inputs and their costs will be lower than their peers. It's all of these things that we generally say to them that there will be future proof but [it] can't be quantified now* (Dairy Co.1).

Factor 4: Attract people to join the company

Dairy Co.1 mentioned that environmental management also helped the company attract qualified people to work in the dairy industry. As many people are getting more knowledge on the impact of the intensification of dairy activities in New Zealand, they are more aware and start to care more about this issue. Hence, when considering job offers, environmental sustainability in the dairy industry has become a concern for potential employees. The interviewee at Dairy Co.1 said:

> *That actually plays a role in us attracting people who are really good. We've hired a new CFO. So, we're talking about the CFO and not just young graduates. And when we asked*

her recently why she joined, she mentioned environmental sustainability as being one of the things that attracted her to the company and that made her join (Dairy Co.1).

4.3.5. Barriers to implementing environmental management techniques

Although dairy companies might want to make sure that their company goals are in line with environmental regulation, there are two barriers to being able to meet the requirements, namely financial constraints and problems dealing with suppliers, as discussed below.

Barrier 1: Financial constraints

Both dairy company interviewees stated that financial constraints are their biggest hindrance to adopting environmental management practices. Dairy Co.1's interviewee gave an example. Her companyreports on its greenhouse gas emissions. From the report, she found that coal is one of the major contributors to the emissions. One of the ways to mitigate this issue is to use renewable energy or electricity. However, given that the factory is big, it is quite hard for the company to switch from coal to electricity because it will cost a lot. She said:

> *The coal that we are using in our factory – we know that coal is the worst type of fossil fuel we have. We have some knowledge on solutions to try to mitigate it as we can. But nope, nobody's perfect … it would require so much electricity and we [would] have to upgrade the entire electrical system at our sites and actually have to try and bring in additional electrical lines. So, it's literally impossible for us … all of these are expensive.*

Barrier 2: Dealing with suppliers

According to the participants, although each company has environmental strategies and objectives in place, it is sometimes tricky to deal with farmers as their suppliers. These dairy

companies are business-to-business (B2B) organisations. Hence, they have to find ways to satisfy suppliers' demands as well as their company strategies. Dairy Co.1's interviewee shared the following:

> *We're a B2B business … we still heavily rely on what our suppliers ask us to do … we can influence and explain what our goals are, but we wouldn't necessarily always have to find words on how it should be. … that's one example where you might have to balance things and it's always a challenge.*

4.3.6. Improving identification and management of environmental costs

Interviewees suggested four ways of improving the dairy industry: provide incentives, use external consultants to audit and review environment reports, set clear goals and tools to achieve them, and allocate environment-related costs to production processes. These are detailed below.

Suggestion 1: Provide incentives

The first way to improve the identification of environmental impacts of dairying is by providing extrinsic tangible rewards to farmers. Dairy company interviewees suggested that the provision of financial incentives would help farmers to transition to sustainable dairy farming. One participant had the following to say: "*A way of rewarding farmers for being more sustainable and having better practices is to financially reward them. So, we pay premiums on the price of milk to farmers that are certified* " (Dairy Co.1).

Suggestion 2: Use consultants to audit and review reports

The dairy industry might want to consider the employment of consultants to audit and review reports to ensure that they are compliant and accurate. Both farmers and dairy companies could

be audited and certified by third party consultants, which would ensure the reports are well-compiled and capture all relevant information. One of the dairy company interviewees is already employing an external auditor to audit their sustainability report. The participant said:

> *We've got [an] environmental management team … that manages our consents and looks at environmental compliance aspects. I know they do rely on an agency … or an external consultant who will notify us on local, regional and national regulations that affect us on our sites whether directly or indirectly* (Dairy Co.1).

Although the other dairy company does not have an external auditor for their sustainability report, the company uses consultants to "*look at where [we] can save energy and use energy efficiently.*" The participant also added: "*Sometimes we get consultants to do it, but most of the time we do it ourselves, as we see the results on a daily basis. It takes us about three weeks to finish it, but we do it in a time when we are quiet"* (Dairy Co.2).

Suggestion 3: Set clear goals and tools to achieve them

The interviewee at Dairy Co.2 suggested that the Government needs to set transparent goals on what it wants to achieve with environmental management, and also provide the appropriate tools to meet the goals so people in the industry know what they should do and how. These goals also need to be well publicised, so farmers and the general public are aware of what is expected by the Government. One interviewee said:

> *Farmers will always try to achieve Government goals. However, not knowing what to do and not having tools to meet those goals, although the goals are well known and*

published and publicised, without those two things, farmers don't know what to do. So, if [the Government] get those two things right, it will be better (Dairy Co.2).

Suggestion 4: Allocate environment-related costs to production processes

One dairy company interviewee realised that accounting approaches to calculating environment-related costs would provide benefits in the long run because farmers could see the results of their current environmental management practices. He added that by working out the cost of waste, farmers could also see the extent of waste and therefore start practices that foster environmental management. The interviewee stated:

The other thing is from an accounting point of view … pricing carbon. We like to call it putting a cost on it. Potentially this would drive any business to do something, to minimise their costs and then there's a whole accounting thing around it (Dairy Co.2).

In summary, the interviews at dairy companies found that emissions of greenhouse gases, and soil, water and nutrient pollution are the noticeable impacts of dairying on the environment. To minimise these impacts, dairy companies do sustainability budgeting, prepare environmental reports, educate farmers on environmental rules, and manage their waste. These actions help dairy companies monitor their gas emissions and manage environmental costs. There were four motivating factors for dairy companies to reduce the environmental impacts of dairying: complying with environmental regulations, maximising productivity on farms, reduce costs, and attracting people to join the company. This section also revealed that financial constraints and suppliers are the barriers to implementing practices that will minimise the environmental impacts of dairying. Lastly, dairy company interviewees suggested that providing incentives, using consultants to audit and review reports, setting clear goals and tools to achieve them, and

allocating environment-related costs to production processes might help reduce the environmental impacts of dairying.

4.4 Interview with a Regulator from Environment Canterbury

An interview was conducted with a Regulator, one of the key people in Environment Canterbury (ECan). This organisation helps the central government in dealing with environmental issues such as air quality, climate change, waste management and water quality. The objective of this interview was to understand ECan's objectives regarding environmental sustainability and to elicit ECan's views on some issues raised by farmers and dairy companies. As a decision maker and having worked with ECan for over than 30 years, this interviewee spoke about how dairy farming in New Zealand has evolved. He stated:

> *It's a very noble profession and it does concern me today that a lot of farmers have been criticised. They certainly feel that they are under the pump, that they've been criticised. And I think that a lot of it is quite unfair. They're working hard … Forty years ago, [the Government] was telling them, "You need to develop, you need to grow more grass and have more animals because the country needs to have more exports and you need to help the country by growing more food." ... Two years ago, the farmers were told, "You're a sunset industry and tourism is the way of the future and you guys should make the land look beautiful to look at"* … (Regulator).

Despite his concern about how farmers are viewed by people in New Zealand, he said that it is part of his job to keep up with the central government's expectations, which are sometimes much higher than ECan's current objectives and strategies. The regulator viewed his main job as:

working with farmers to understand the impact of what they do on water and then to help them to develop ways of farming that can minimise that impact and sometimes that's easy and sometimes it's very tricky.

In terms of the communication between ECan and farmers, the Regulator agreed that ECan is not the main point of contact and the main source of information when new policies come out, which sometimes make things more complicated. Because of this, ECan is working hard with the New Zealand dairy representative bodies to ensure farmers' voices and opinions are taken into account when preparing new policies and to improve their current strategies. He mentioned:

… but in terms of the scale of trust, who do farmers go to for information that they really can trust? ECan is not the highest, sadly. Government is not the highest when it comes to a source of trusted information for most farmers. It will be the neighbours … they will go to them for information…In terms of …how we get the information out there, we work a lot with industries, and we communicate with them... DairyNZ, Beef + Lamb NZ, the Foundation for Arable Research, those are the big industry bodies (Regulator).

The participant identified specific roles for the above industry bodies in filling the gaps between farmers' expectations and government objectives. This is done through continuous discussions, research and development, and education programmes. He also expanded on the ways ECan is involved indirectly during the discussions to learn about farmers' concerns and, at the same time, acquire a knowledge of the current state of what happens on the ground. For example:

We get [the industry bodies] to be on the same page as we are, and they move together with the community… sometimes they will organise a meeting with the farmers, and they

might invite us along and we will either do a presentation or we will just mix and mingle with the farmers and answer questions. So, that's an important source of communication for us… Having us up on the stage for the whole time, giving a talk and talking to the farmers will just invite argument. It doesn't help. It doesn't work and it's not an effective way.

The Regulator claimed that ECan is not only cooperating with the three biggest dairy industry bodies, but also working with other people in the dairy industry such as dairy companies, irrigation companies, fertiliser companies and the horticulture industry to ensure ECan's objectives and plans are communicated across the industry. He stated: "*While working with industries that I mentioned, …there's also dairy companies like Fonterra and Synlait. And we also work with the irrigation industry"* (Regulator).

The Regulator added that YouTube is another effective way of conveying information to farmers. Based on his surveys and studies with farmers across the Canterbury region, he found that this channel will be used more efficiently in the future as farmers have internet connections in their house or on-farm, hence they can watch short videos in their own time and at their own pace. He said: "*… it's really hard to get independent information, but … a lot of farmers go to YouTube, and they learn how to grow stuff, which is pretty amazing actually"* (Regulator).

This interviewee also reinforced some of the points raised by farmers in their interviews. Farmers noted that a Farm Environment Plan is a compulsory document all farmers in Canterbury need to prepare. As one of the government officers and the person who is directly involved in the Farm Environment Plan, the Regulator described this document as an observation tool that will be used in their future plan and as part of environmental reporting to

other stakeholders concerned with environmental issues such as the Ministry for the Environment, the Organisation for Economic Co-operation and Development (OECD) and public citizens.

> *… part of it is used to feedback on our plans where we can, and part of it is our responsibility as a public body to report to the public… Every three years we produce a state of the environment report … [about our] lakes and rivers: what's the quality now? Is it improving? Is it degrading? Is it levelling off? And we also feed information into the Land Degradation Assessment in Drylands (LADA), … all councils in New Zealand contribute towards this website. So, you can log in, let's say to Waimakariri River, to get data on water quality... we have to publish that on an ongoing basis and that allows you and anybody else to come along and look at the quality and the trends. We do the same thing for the … water flows. So, if you Google on ECan and just put in water quality … that's for the public reporting. We also have to, from time-to-time, report to the Ministry for the Environment, and we also have to report to the OECD, every now and then* (Regulator).

With regard to the lack of transparency in the environmental policies that farmers and dairy companies mentioned in previous sections, the Regulator admitted that these inconvenient incidents really happen and indicated that one of the reasons is because the rules and regulations are decentralised across New Zealand. He pointed out the advantages and disadvantages of this situation:

> *The good is that you have local solutions for local problems. The bad is that you have inconsistency at work. You have perceived inconsistency as well as real inconsistency because some councils haven't got the money. If you look at the West Coast, 14 or 15% of the land area is farmed and they have to pay for the management … of the whole*

region as they haven't got the resources that we have, for example, here in Christchurch, in the Canterbury regional council, to do the job… You might get inconsistency there, but you also have the local discretion, …[It's like being caught by] a policeman if you're speeding – sometimes it depends on your attitude, depends on how fast you were going. It depends on whether you did it yesterday as well. They will either let you off, or they will give you a ticket and it isn't always the same – different places, depending on so many things – if you have children in the back, screaming away, and what's your reason for speeding, all that kind of stuff (Regulator).

However, the Regulator suggested that although the New Zealand dairy industry should have regulations that are the same for all people at a national level, the central government also needs to provide guidelines which will be different, depending on the regions in New Zealand. This is to ensure that farmers will have a clearer direction on what they should report and how they have to alter their current farm practices while being on the same page as other New Zealand farmers outside the Canterbury region. He said:

I think [central government] need to have a centralised standard. But I think [central government] need to let each council work out how best to implement that within the regions. There's only 16 of us… it's not like hundreds of us councils. For example, even within Environment Canterbury, we found that one approach doesn't work …some areas need to have 30% reductions in the nitrogen level …and other areas we're talking about 80% or 80% plus reductions… so even within our region, it's not a one-size-fits-all compliance. So, I think national standards, but local implementation and delegations as well (Regulator).

When the Regulator was asked about the challenges policy makers such as ECan face in terms of farmers' perceptions about environment-related policies and their acceptance of the current rules, he replied:

> *Getting farmers to know what they [the policies] are is the first challenge. But the second one is trying to communicate it in a way that [conveys:] "Yes, we understand [your] pain. Yes, we understand that this is not what I've told you two years ago, because things are now changing. And yes, I know that people in town also have dirty rivers and yes, I know that they complained about what happens out in the country and they should totally start with their own backyard first, … but that doesn't get you off the hook. You still need to do your bit…" So, I think the biggest challenge has been trying to convince farmers that this is something that is not going to go away and try to put it positively so that we can say, "Look, we actually want you to grow food sustainably"* (Regulator).

The perceived free rider problem alluded to in this quote results in a lot of complaints from farmers, who claim that they are not the only contributors to the current state of the New Zealand environment. The Regulator stated that a change in behaviour is required by everyone in New Zealand, not just farmers, with everyone doing their part to make the New Zealand environment better. For instance, he said:

> *[When] people buy your food and look at your products, when something comes from New Zealand, they can be confident that this was grown sustainably. That's a hard one because it is like people [who] talk about wanting to buy … eggs from cage-free farms and [say] they'll pay a premium for that, but [when] you look at their shopping basket, [they actually buy] the cheapest ones they can get. …*
>
> *I want to highlight the fact that if somebody said to you, do you want to be able to swim in the Avon River? I'd say yes, of course I do. And I want to be able to fish in the river.*

But do I want to pay for all of that? No, I don't want to pay that much. I can't afford it. So, telling farmers that they need to be better, it's easy because it doesn't cost me anything but when it comes to me doing better, because it was a cost to me, I will not do that. But if you're weighing up the cost and the benefit you will come to a different decision. … So that line of sight that I talked about, [where] we want to see beautiful water, but what it means for the farmers, the relationship is not well talked about and not understood (Regulator).

The interview with the Regulator provided insights into the connection of the whole system. ECan is aware that there are limitations in their communication particularly in regard to making sure that the objectives of ECan are well understood; encouraging farmers to care about the environment; and getting farmers to report the environmental impacts to ECan. ECan makes use of other people in the industry such as dairy manufacturers, DairyNZ, and the Foundation for Arable Research to work more closely with the farmers, as farmers trust those organisations more than the regulator. The other challenge the Regulator recognised is about a centralised standard which is aligned with the farmers' and the dairy companies' views. Such alignment may be important in the improvement of the whole dairy environmental policy structure.

4.5 Interview with an Agribusiness and Commerce Academic

An interview with an Academic was conducted to explore his views on how agricultural businesses in New Zealand account for their impacts on the environment. This academic not only teaches students at a university but also educates farmers in New Zealand about social concerns regarding environmental issues such as water quality and greenhouse gas emissions. The Academic also has practical experience of managing farms in the United Kingdom, so he

is able to share his work experience with New Zealand farmers to help them improve environmental outputs and farming systems.

According to the Academic, New Zealand farmers have the potential to change and would like to change but they need support to cope with the massive changes in policies and regulations across the dairy industry. For instance, the Academic made a comparison with the UK dairy industry, where their government gives "*a considerable amount of carrot and a tiny amount of stick"* whereas in New Zealand it is the other way around. One of the ways to encourage the UK farmers to focus on environmental sustainability is by giving subsidies to them. Also, there is an agri-environmental scheme in the UK to financially incentivise farmers to help them implement sustainable on-farm practices.

He highlighted the need for farmers to "*understand the whole process – the reasons for introducing the new environmental rules and policies*." This is because when changes happen, actions to control them will be necessary. Otherwise, farmers will become "*rebellious*" as changes mean they need to sacrifice more time and resources to ensure the changes are well-executed. Consequently, some farmers may decide to defer making the changes. According to the Academic, "*to help dairy farmers to comprehend the paradigm shift, they need to be educated*." Policy makers and regulators should be clear in letting farmers know "*what*" is the change and "*why they have to change*", and then listen to how farmers respond to the introduction of the new policies. Furthermore, policy makers also need to find ways to demonstrate the steps to change that help farmers have a clear direction towards environmental conservation and "*so that they can make an informed decision because they are aware and have enough information to deal with it*."

The Academic asserted that education from other people in the dairy industry is also crucial to supporting farmers so that they are able to bring about this change. At the same time, farmers "*cannot ignore the social concerns about their current practices*". For example, farmers also need to engage with other stakeholders such as their consumers, milk companies, and regulators to understand their expectations. This "*two-way educational relationship*" can build better understanding resulting in farmers being confident to accept the change, which will benefit farmers and the wider dairy industry while also mitigating environmental impacts.

The Academic also mentioned the economic and production implications when environmental policies are put in place. He suggested "*accountants could take a financial approach in terms of developing simple methods to calculate the economic benefit*" of the changes, perhaps by doing financial analysis and using simple accounting terms to report so that everyone will be able to understand the information. This could help farmers implementing the changes to see the benefits of doing them.

The Academic emphasised that this whole process is a "*learning process*" in which the whole industry needs to work together in order to enact meaningful changes. For example, the industry could recognise and understand the various approaches to mitigate the environmental concerns that the media constantly talks about.

4.6 Interview with an Environmental Consultant

A brief interview was conducted with an Environmental Consultant in Canterbury. Her role is to encourage farmers to comply with environmental policies such as the Farm Environment Plan. She also assists farmers in improving their nutrient budget and provides them with reports on how to improve their current practices related to nutrient losses and greenhouse gases

The Environmental Consultant views environmental sustainability in dairying as an urgent matter, believing that farmers need to be environmentally sustainable in order for them to continue their business operations. She said:

> *[Environmental sustainability] is very important at the moment … if farmers want to survive in this industry, they need to find ways to work with the landscape so that [the landscape] will not be getting worse… it's a big task for farmers to go back to the point where environmental pollutions are not an issue.*

The Consultant also pointed out that it is not easy for some farmers to recognise the importance of considering the environmental impacts of dairying when making a decision. However, some farmers are trying to do their best to protect the environment. She stated:

> *Farmers need time to understand that they must have a big change of mindset… It's not an easy task… A lot of farmers now realise that they need to change some of their practices … Some are not very keen (they think it's a conspiracy theory), but there are plenty that really do what they have to do by working well with nature and minimising harm … because a lot of dairy farming businesses want to pass on to their children, so they don't want to destroy the nature.*

The Environmental Consultant claimed that she does not find many problems in encouraging farmers to take actions that will improve the environmental impacts of dairying. This is because the clients that come to her for consultations are "*people that are already interested to improve their business operations [so that it will improve the environmental impacts], hence I don't have to argue [with the farmers].*"

However, in general, environmental consultants do feel some pressure in carrying out their job. Firstly, some pressure may come from farmers who view the consultants as an increase to the farmers' expenses. She said that in order to achieve environmental compliance, some farmers must hire environmental consultants to assist them with planning and completing the requirements set in the environmental policies. For example, she mentioned:

> *To farmers, I am an expense because what I've been doing is to help them with paperwork for all the tasks related to environmental plans… [These are] things that they did not have to do when they first started as farmers…and the paperwork has been increasing and they have been spending so much time in the office… They don't have time as they also have to be on the farm, so they hire me to do it for them… It is an [extra] expense farmers have now.*

Secondly, the pressure that environmental consultants are experiencing is also due to the changing regulations. The Consultant claimed that keeping up with constantly changing environmental regulations and policies is stressful, but they need to be up to date in order to provide recommendations and solutions for farmers. She shared the following:

> *I'm actually quitting that job because it is so overwhelming. There are so many regulations that change all the time …I can see why the farmers are overwhelmed with the environmental regulations.*

In addition, the Consultant noted that there are not only changes in the environmental regulations, but there are different environmental regulations in various areas of Canterbury as well. For example, she said:

> *[the regulations] are different in every area … even in Ashburton, [we've] got four or five different rules in that area … So you must know which [area your clients] are in*

and what are the environmental rules [for that area] … [For example,] there are different irrigation schemes, depending on where farmers get the water [from], hence the rules will be different … It's getting harder for farmers to keep up just with the complexity of the regulations …A consultant …needs to get their head around all these things before she can tell farmers what to do so they [understand] and can do it.

Although farmers' responses to the ever-changing environmental regulations varied, many farmers get overwhelmed. This is because farmers are eager to change their actions immediately in order to reduce the harm to the environment, and also, to meet the current environmental target set by the government. But eventually some farmers only change when the targets become complex, because they lose their interest in keeping up. She mentioned:

[The response] depends, but a lot of them get overwhelmed… New Zealand dairy farming has gone through a lot of changes… Everyone still remembers that in the [19]80s, when the farm subsidy was taken off, a lot of people lost their farms, and it changed the nature of farming forever …Then Canterbury was converted to dairying, so it's not like other countries I suppose, where regulations and laws might be the same for hundreds of years but not [in New Zealand].

The participant also agreed that farmers had spent a massive amount of time and money on environmental compliance. "*There's so much going on with the environmental regulations… all farmers are busy but not all have environmental staff to be up-to-date with the regulations*". In addition to that, "*[there is] a lot of inefficiency with recording the farm data …some of [the environmental information] is redundant*".

4.7 Chapter Summary

This chapter presented the findings from the interviewees: farmers, dairy company managers, a regulator, an academic and an environmental consultant. The questions asked in the interviews were designed to find the interviewees' perceptions of the environmental impact of dairying and what the interviewees were doing in order to quantify and report these impacts.

All interviewees view environmental sustainability as doing business while working well with the environment so that future generations can still enjoy nature as we do today. In addition, the interviewees are all aware of the environmental impacts of dairying. Interviewees from the dairy companies perceive the main contributor to environmental problems in New Zealand dairying as being the emission of greenhouse gases, and soil, water and nutrient pollution. Although farmers acknowledge the urgency of reducing environmental impacts, they believe that the financial sustainability of their business is more important because the results of improving this aspect of sustainability are more tangible than the outcomes to lessen the impacts on the environment.

Farmers use some EMA techniques, such as preparing a Farm Environment Plan, and dairy companies measure and report environmental-related information such as nitrogen and fertiliser usage and water management. The interviewee from the Regulator sees reports demanded from farmers and dairy companies as an observation tool for ECan itself and for environmental reporting to other stakeholders concerned with environmental issues such as the Ministry for the Environment, the Organisation for Economic Co-operation and Development (OECD) and public citizens. Farmers use environmental management online software to calculate, monitor and analyse their farm operations, and one of the interviewees uses

environmental related cost accounts in her accounting system. One dairy company budgets for environmental costs and revenues and utilises the information for decision-making.

It can be concluded that farmers are not yet aware of the benefits of implementing EMA techniques, whereas the dairy companies use EMA techniques for monitoring their gas emissions and farmers' gas emissions and to manage the identified environmental costs.

The main reason that farmers and dairy companies use EMA is because they are required to, that is, for compliance. Other motivational factors for the use of EMA by farmers include economic returns, support from the farm's owner, reputational image and self-gratification. For dairy companies, other reasons for implementing EMA techniques are to maximise productivity on-farm (which increases productivity of the dairy companies), to help farmers make more profit, and to attract top talent to the dairy companies.

Farmers identified nine barriers to using EMA techniques. Most of these barriers relate to problems with compliance, arising from hastily prepared environmental proposals lacking clear directives and guidance; regulators' negative attitudes; a lack of reward for compliance; impractical and unworkable environmental regulations; and high compliance costs. Other barriers to implementing EMA techniques include difficulties in calculating environmental costs; a short term focus; problems with information collected; and organisational siloing. For dairy companies the financial constraint is the most significant barrier to EMA implementation. The pressure that they have as Business-to-business organisations is also a barrier for them to implement EMA techniques.

Improving environmental standards and regulations may help overcome compliance barriers. Consistent and integrated software packages might assist withthe problems with environmental information collected. In addition, farmers also suggested improved communication as a solution to the lacking of clear guidance, the negative attitudes of some regulators, and the organisational siloing. Furthermore, showing the benefits of factoring in environmental costs over the long term would help provide some extrinsic motivation as well as a longer term focus. In the long term, addressing these issues may reduce the compliance costs.

The dairy company interviewees and the Academic argued that the provision of incentives would help farmers improve the implementation of EMA techniques. One dairy company participant also proposed that those farmers allocating environment-related costs to production processes and using consultants for audit and review their reports may be able to improve their identification and management of environmental costs. Education is essential so that farmers can understand the environmental rules and policies, and how calculating environmental costs and using other EMA techniques provide economic benefits to farmers as well as to the environment. Farmers need to have a change of mindset, so they embrace the changes in actions they have to make to ensure the environmental impacts of dairying can be improved. However, the Environmental Consultant emphasised that this will takes time.

Regulator, such as ECan, realise that they are not effectively communicating with farmers. The interviewee from ECan suggested using other communication channels, such as YouTube, to convey information to farmers because they can watch videos in their own time and at their

own pace. Both regulators and consultants need to convince farmers that they understand their difficulties in taking actions towards being environmentally sustainable and the time and cost of compliance.

The following chapter will discuss and synthesise the research findings from the interviews conducted among farmers, dairy companies, the regulator, an environment consultant and the academic in this chapter with the relevant literature presented in Chapter 3.

Chapter 5: Discussion

This chapter discusses and synthesises the research findings from the interviews conducted among farmers, dairy companies, a regulator, an environment consultant and an academic, which were presented in Chapter 4. First, the perceptions of environmental sustainability are considered. Then, some aspects related to EMA techniques are discussed: implementation; motivations for implementing; and barriers to using EMA techniques. Finally, ways to improve the identification and management of environmental costs and information are proposed.

5.1 Perceptions of environmental sustainability

Participants in this study perceive environmental sustainability in dairying as a way to provide people with food while maintaining the current environmental situation, in such a way that generations to come may still be able to enjoy nature as it exists at the moment. This perception is in accordance with the environmental sustainability definition in the Report of the World Commission on Environment and Development: Our Common Future (1987): "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". While exploring their perceptions, respondents acknowledged that there are various negative impacts of dairying on the environment, especially the emission of greenhouse gases, soil pollution and water pollution. They unanimously agree that they have to take actions to reduce these impacts. This is also in accordance with prior studies by Diniz et al., (2015), and Kiełbasa et al. (2018), whose respondents believed that farming activities would impact the environment negatively, and provided ways to combat these issues so as to improve environmental sustainability. These include technology innovation, guidance and support from agricultural organisations, and information channels where farmers can seek advice on how to combat these impacts. This is also in line with the interviews, where it was

found that guidance and support from the regulators is also important for farmers to improve the negative impacts of their farming activities on the environment.

In the current research, both farmers and managers of dairy companies indicate that they understand the benefits of being environmentally responsible. In practice and from the interview, however, there are some farmers whose main focus is on making a profit as economic performance of the business seems more tangible. Although farmers acknowledge that improving the current state of the environment has advantages, this might not be their priority as they also consider other elements of their business. Similarly, Oo and Usami (2020), and Kiełbasa et al.'s (2018) found that even though farmers understand the adverse impacts of dairying on the environment, they will take into account other factors, such as the opportunity costs of implementing actions that have a positive environmental impact, and how easily they can access information and education, and economic performance, before doing so. In addition, according to the literature on the Triple Bottom Line, it is important for farmers to not only think about financial sustainability of their business but also to prioritise people and the planet, which will reduce their organisational risk, increase the business resilience and minimise their costs (Svensson et al, 2018).

As discussed in the literature review, farmers' perception of environmental sustainability is essential as that can influence farmers' actions towards preserving the sustainability of agricultural land (Creemers et al., 2019; da Motta and Ortiz, 2018; Oo and Usami, 2020). In this research, it was found that perceptions of people in the dairy industry regarding environmental sustainability and adverse impacts of dairying do have an effect on their practices. The subsequent sections discuss these findings.

5.2 Implementation of Environmental Management Accounting techniques

Kamruzzaman (2012) and Bennett and James (1998) argue that there are various EMA techniques. Literature relating to EMA frameworks and methods highlight that there is no single and simple way to calculate environmental costs (Jasch, 2020). This study augments the existing yet limited literature on EMA and EMA techniques by showing that all dairy farmer interviewees in Canterbury adopt some EMA techniques, such as preparing a Farm Environment Plan (FEP) to identify environmental risks in farming, and use environmental online software to help them monitor and record their farm's environmental information.

The EMA techniques which the interviewees implemented align with the EMA framework of Burritt et al.(2002) illustrated in *Table 1* (see p. 16). However, their emphasis is on Physical EMA rather than Monetary EMA. For example, there is information in the Farm Environment Plan about ex-post assessment of short term environmental impacts, relevant environmental impacts, and long-term physical environmental planning, but none of the Monetary EMA tools in the framework are reported by farmers. Even the concept of "budgeting", which could be thought of as an accounting term, is actually used in relation to physical environmental information (i.e., the nutrient budget), and it involves reporting on past nutrient management performance rather than providing future-oriented information. It seems that the policymakers, who set out what should be in the FEP, do not have a clear definition of budgeting, which results in farmers being confused. Thus one can question whether the FEP is really a plan and whether it impacts the future processes on the farm to be more environmentally sustainable.

5.3 Motivating factors for EMA implementation

In the current study, compliance with regulations is the main motivation for farmers and dairy companies to implement EMA. The need for farmers and dairy companies to comply with the

ECan environmental guidelines has pushed them to ensure that they complete the FEP and interact with the environmental software packages. In addition, regulators impose penalties on those who violate the regulations. These finding are consistent with several studies that utilise institutional theory to explain the motivating factors for EMA implementation (see for example Hussain and Gunasekaran, 2002; Jamil et al., 2015; Latif et al., 2020). The studies conclude that coercive pressure from local government's standards and regulations could be a strong reason for organisations to implement EMA. The findings are also in line with AICPA (2019) that stated a reason to implement EMA techniques is to gain legitimacy. This study also found that mimetic pressure has a significant influence on the implementation of EMA. For instance, although there are still uncertainties with the implementation of EMA techniques such as the economic benefits of implementing EMA techniques and information collected, farmers and dairy companies implement EMA techniques because the whole dairy industry is moving towards environmental sustainability. As a result, they eventually adopt the same practices as other farms and organisations in the industry. However, this findings is in contrast to Wang et al. (2019) and Li's (2004) study who argue that mimetic pressure is not an important motivating factor for businesses to implement EMA.

Another motivating factor found in the current study for why farmers and dairy companies adopt EMA is their reputation. This finding is consistent with that of AICPA (2019), who found that Australian companies pay attention to reporting environmental performance in order to improve their reputation and to attract potential investors. Furthermore, this study found that dairy companies account for the environmental impacts of dairying in their reporting and adopt EMA techniques in order to attract potential employees. This implies that organisations are trying to implement EMA techniques in order to maintain their image and to impress external stakeholders including future investors and potential employees.

According to AICPA (2019), another reason for implementing EMA is cost-saving. Prior studies showed that by implementing EMA, organisations are able to reduce waste processing costs and losses from raw materials (Agustia et al., 2019; Burritt and Saka, 2006). However, it was found in the current study that only physical EMA is reported and the majority of the farmers do not separate out environmental-related costs from their total costs. Therefore, the cost saving does not seem to be a factor for the interviewees, as there are no indicators of comparison of costs or whether their EMA practices contribute to cost saving. Further, farmers cannot anticipate any reductions in their waste management costs because they are not able to quantify their environmental expenditures in monetary units.

5.4 Barriers to using EMA techniques

The majority of the farmers and dairy company interviewees mention the lack of guidance from the regulators as the main hindrance to implementing EMA techniques. This is consistent with prior studies which found that the major barrier to the development of EMA is a lack of proper guidance from the government (Setthasakko, 2010; Walker et al., 2008; Mathiyazhagan et al., 2014; Menon and Ravi, 2021). However, the interviewee from ECan revealed that farmers do not trust the sources of ECan information. This implies that there is miscommunication between them. Farmers mention a lack of on-the-ground participation by the regulators. Some interviewees argue that if regulators engage directly with the farmers and work together with them, not only would the regulators identify the information they need to give to farmers, but it would also improve trust. This could result in farmers becoming knowledgeable about what is required and why, and ultimately, they might become more willing to abide the regulations. This could improve the implementation of EMA techniques in the future.

This study also found that the attitude of the regulators is a major barrier to the implementation of EMA techniques. Regulators could be more proactive about giving clear direction to farmers on why and how they should calculate environmental costs. On-the-farm help would also address farmers' concerns about the complexity of and confusion about how to calculate and report the environmental costs. A win-win solution must be arrived at not only to ensure that farmers comply with the EMA techniques and that they implement them, but also seeing how this measurement and reporting can result in positive effect for both economic and environmental sustainability.

This study found that although high environmental compliance costs and a lack of financial incentives are not the only hindrance to EMA techniques, they do result in farmers not implementing EMA techniques to the fullest. These findings are similar to other studies' findings that financial barriers such as resource constraints and lack of financial rewards hinder organisations from implementing practices that might mitigate environmental impacts (Walker et al., 2008; Bhandari et al., 2019). While Kamruzzaman (2012) and Burritt and Saka (2006) actively promote the implementation of EMA techniques by citing the reduced environmental compliance costs, the farmers in this study, unfortunately, are not receiving enough guidance from the regulators on ways to implement the EMA techniques. As a result, they have to invest large amounts of money and time to comply with the environmental regulations.

The current study supports Burritt's (2005) and Dillard et al.'s (2005) findings that inefficiencies in data gathering and poor systems to manage and measure environmental costs have made it difficult for managers to segregate environmental costs from total production costs. As a result, farmers do not try to separate the environmental costs, but instead assign them to overhead accounts. Hence, this research suggests that dairy industry bodies including

regulators, dairy companies, irrigation companies, fertiliser companies and environmental software companies need to work together to develop an environmental software system that integrates all environmental-related costs into one robust software system. Improving the current environmental system could help farmers to improve their current environmental reporting and reduce the time and money needed to manage the environmental information, and in the long term, could help to reduce the environmental impacts of dairying.

5.5 Chapter Summary

Overall, the findings of this study make an empirical contribution to the literature by including the perceptions of people in the dairy industry in terms of environmental sustainability. The data provided can lead to EMA usage by providing more evidence on measurement and reporting of the impacts of dairying on the environment, thus adding to the studies of Creemers et al. (2019), Kiełbasa et al. (2018), and da Motta and Ortiz (2018). For instance, Creemers et al. (2019, p. 628) concluded that: "Dairy farmers are more likely to change the existing production scale than to maintain it if they perceive that this production choice affects environmental sustainability to a higher extent." Prior studies have not investigated farmers' practices, whether and how they are measuring and reporting the negative impacts of their operations— this gap is being filled by this research. By providing details of perceptions and practices of farmers in terms of environmental-related aspects, this research provides part of the overall picture of farming practices in New Zealand and the implementation of EMA techniques.

The upcoming chapter will present the conclusion of this thesis, the study's contribution, the research limitations, and future directions.

Chapter 6: Conclusion

This chapter draws conclusions from the findings and analysis in previous chapters. Furthermore, this chapter of the thesis is comprised on contribution of this research. Limitations of the study are followed by recommendations for future research.

6.1 Conclusion

The main aim of this study was to explore the usage of EMA techniques in the dairying industry in Canterbury New Zealand. People in the dairy sector were asked for their views on environmental sustainability and the negative environmental implications of dairying. The research uncovered the practices of people in the industry towards measuring and reporting these impacts, which is by adopting EMA techniques. Semi-structured interviews were performed both with practitioners, namely farmers and dairy companies operating in the Canterbury region, and with other people with the ability to influence the practices of the practitioners: a regulator, an academic, and an environmental consultant.

The interviews revealed that farmers and dairy companies view environmental sustainability of dairying as a way to provide people with food while sustaining the current environmental situation, such that generations to come can continue to live in a similar way to current generations. Farmers and dairy companies' managers acknowledged the negative impacts of dairying on the environment and hence knew that they should take actions to reduce these impacts. However, the majority of them focus on managing their businesses for profit, that is, for economic sustainability. In addition, farmers stated that they are motivated to implement EMA practices when there is the potential to generate significant income, because the economic benefit is more obvious.

Further, the study found that all farmers and dairy companies implement some EMA techniques to measure and record the adverse environmental impacts of their business. Nevertheless, an analysis of the motivating factors and the barriers to use the EMA techniques identified some gaps between these participants' perceptions of the negative impacts of dairying and their practices to measure and report these impacts. The participants believe that their reporting and measuring of the negative impacts of dairying are not necessarily effective in achieving environmental sustainability.

Farmers and dairy companies implement EMA techniques mainly to comply with ECan regulations. Other minor factors motivating implementation of EMA techniques were economic returns, farm owner support, and reputational image. One of the farmer interviewees invests some effort into environmental conservation in order to achieve internal self-satisfaction. This is because this interviewee is very positive that implementing environmental management techniques including EMA will help in reducing the environmental impacts of dairying.

All farmers and dairy companies found barriers to using EMA techniques: compliance barriers, constraints in terms of calculating environmental costs and EMA techniques implementation, a short-term focus, problems with information collected, organisational siloing, financial constraints, and dealing with suppliers. Due to these barriers, EMA practices are not necessarily effective in improving the adverse impacts of dairying on the environment.

6.2 Contribution of the research

This research makes three contributions to the literature on Environmental Management Accounting. Firstly, this study adds to prior research by examining the usage of EMA,

motivating factors and barriers to it in a different sector, namely the primary industry sector. Despite EMA having existed since the 1990s, this study found that many in the dairy business are still unfamiliar with it. The use of EMA's mechanisms for calculating monetary and environmental costs remain uncommon. Furthermore, prior literature has suggested numerous frameworks for EMA but none of them provide a comprehensive or effective way to reduce the cost of environmental impacts.

Secondly, this research could also help the New Zealand central government and regional councils to improve their environmental policies and regulations and compliance with them, by ensuring that the principles behind the policies are clearly communicated and relevant to the farmers who have to measure and report on their compliance with them. Better relationships and communication between regulators and farmers could help ensure that the measurements and standards are not onerous, and that they will be effective in sustaining the environment.

Lastly, this study makes a practical contribution in that it provides an overview for the NZ Government of the current practices towards reducing the environmental impacts of dairying, which was discussed in Chapter 3 and 4 of this thesis. This might enhance its education of farmers and dairy corporations about the necessity of reducing environmental impacts of dairying and the benefits of monitoring those impacts and costs. This study shows how environmental authorities, farmers, dairy corporations, dairy bodies, academics, accountants, environmental consultants, environmental experts, and others in the dairy industry could collaborate to address concerns, and develop good practices and feasible solutions. This, in the long run, will help ensure a decrease in the environmental impacts as well as the operational costs of dairying in New Zealand.

6.3 Research Limitations

This study has had some limitations that are beyond the control of the researcher. Because of the limited time frame in which to carry out this Master's research, only ten people were interviewed, all in the Canterbury region. Therefore, it is acknowledged that this study's results may not be representative of the entire New Zealand dairy sector. Also data were collected only through semi-structured interviews, and were not supplemented or validated with any other source or tool, such as participant observations.

However, the findings came from a range of people involved in environmental reporting from the dairy industry, in a region with a lot of dairy farms. Thus, although the study's findings may be perceived to be only a small contribution, it is a starting point to expand the literature on EMA into this sector.

6.4 Future Directions

Researchers in the future may wish to add to the findings of this study using a quantitative research design. Also future researchers might employ other qualitative research tools, such as participant and non-participant observation and document analysis, enabling triangulation of the findings.

It is also proposed that a bigger scale study on Environmental Management Accounting in New Zealand dairying be conducted, examining the perspectives and practices of a broader range of farmers and dairy enterprises from various locations. Furthermore, conducting interviews with various other people in the dairy industry, such as dairy industry representative groups, dairy industry lobbying organisations, and Māori dairy farming organisations, could extend this research and might help to develop Environmental Management Accounting techniques

tailored to the dairy industry. This study could also be extended to other primary industries both in New Zealand and abroad.

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Appendices

Appendix 1: Information Sheet for Participants

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UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

[Date]

HEC Ref: HEC 2020/18/LR

Environmental Management Accounting in the Agriculture Industry
Information Sheet for farmers in the Canterbury region / dairy company / regulators / advocacy organization

I am Inani Husna Zamri currently studying for a Master of Commerce in Accounting. For my thesis, I am carrying out research exploring how agricultural businesses in New Zealand account for their impacts on the environment. I am asking various people involved in agriculture about conservation and environmental issues. I would like to talk to you about your views.

You have been approached to take part in this study because as a manager you are in an ideal position to give me valuable first-hand information from your own perspective. I have located your contact details through networks I have including friends and contacts within the agricultural industry / your website.

If you choose to take part in this study, your involvement would be an interview which should take about 30 to 60 minutes. This will focus on your views about the New Zealand farming sector, its conservation of the environment, and what management accounting practices, if any, could help address environmental issues. The interview will take place at a time that suits you. The information you give me will be kept confidential and your name will not be mentioned if you wish to remain anonymous. I will audio record what you say and you can see and alter the transcript if you wish. I will only use information in my dissertation that you have consented to. At the conclusion of the interview, there is no further involvement needed, but you are able to contact me at any time.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your interview transcript or recording to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you.

The results of the project may be used in future publications and presentations beyond the Honours dissertation, but you can be assured of the complete confidentiality of data gathered. Only my supervisor and I will know your identity and that you participated, and have access to the data. I will also remove any information that may lead to your identification. The recording and transcript will be securely stored on my password-protected laptop in my locked flat and will be backed up on my university hard drive that is protected by a secured login. These will only be accessed by myself and will be destroyed after 5 years, in line with University of Canterbury Guidelines. Please indicate on the consent form if you would like to receive a copy of a summary of the results of the project.

The project is being carried out *as a requirement for the Bachelor of Commerce with Honours* by myself, Inani Husna Zamri, under the supervision of Dr. Beverley Lord. I can be contacted at iza19@uclive.ac.nz and Bev can be contacted at beverley.lord@canterbury.ac.nz. We will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it to me, Inani Husna. We will provide you with a copy of both the consent form and information sheet if required.

Appendix 2: Consent Form for Participants

Department of Accounting and Information Systems
Telephone: +64 27 512 8895
Email: iza19@uclive.ac.nz

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Environmental Management Accounting in the Agriculture Industry
Consent Form for farmers in the Canterbury region / dairy company / regulators / advocacy organization

Please tick each statement that you agree with:

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand that participation is voluntary, and I may withdraw at any time without penalty.
- ☐ I understand that any information or opinions I provide will be kept confidential to Inani Husna and Beverley Lord and that any published or reported results will not identify me or provide any identifying factors.
- ☐ I understand that the findings developed during the course of this research may be used in future publications and presentations beyond the Honours dissertation
- ☐ In view of the requirements of research, I agree that my responses will be audio recorded.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years, in line with the University of Canterbury guidelines.
- ☐ I understand that I can contact the researcher, Inani Husna Zamri, iza19@uclive.ac.nz or her supervisor Dr. Beverley Lord, beverley.lord@canterbury.ac.nz for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)
- ☐ I agree to be named on any written reports about the study.
- ☐ I would like a summary of the results of the project.
- ☐ By signing below, I agree to participate in this research project.

Name:_____ Signed:_____ Date:_____

Email address *(for report of findings, if applicable)*:_____

[Please sign this form before commencement of the interview]

Appendix 3: Draft Email for Participants

Subject: Invitation to Participate in a Research Study

Dear Mr/Ms A:

I am writing ask if you would agree to be interviewed by me as part of my research exploring how agricultural businesses in New Zealand account for their impacts on the environment.

I am currently enrolled in the Master of Commerce in Accounting at the University of Canterbury, and am doing the research for my Honour's Dissertation.

The interview would take around 30 to 60 minutes and is very informal. I am simply trying to capture your thoughts and perspectives on the New Zealand farming sector, its conservation of the environment, and what management accounting practices, if any, could help address environmental issues. Your responses to the questions will be kept confidential.

If you agree to participate, you will be given an information sheet and a consent form (copy enclosed) to be signed and returned to me, Inani Husna, either via e-mail or at the beginning of the interview process. The interview findings of this study will remain absolutely confidential and any quotations from your interview will be anonymous unless you don't mind being named.

Your agreement to be interviewed will be greatly appreciated.
If you have any questions or concerns, I would be happy to answer them.

Appendix 4: Interview Guide

Interview Guide

Main objective: To explore how agricultural businesses in New Zealand account for their care for the environment.

For the farmers (might be farm manager)

Idea for icebreaker: How long have you been on your farm? What inspired you to go into farming? Has anyone else in your family been involved in farming?

Farm Practices

1. How do you manage the business activities on the farm (i.e., who does the accounting? Who deals with the milk company? Who manages calving?)
2. Could you describe: the decision-making process of your company: information flows; decision making levels and structures; who you have to get sign-off from; planning and control?
3. What do you think about environmental sustainability and how does it relates to farming?
4. What is your farm currently doing in relation to environmental management (e.g. rules, policies or procedures pertaining to water, energy, soil, greenhouse gas emission anywhere in the entire supply chain)? Who collects the information? What information do you have to collect? Who uses the information? What is the information for?(i.e., is it for making decisions on the business process relating to routine planning and control activities, or environmental management activities?)
5. Do you think it is possible to identify and calculate the costs of activities that potentially have an environmental impact?
    a) If yes, how would you do that (the structure, techniques and procedures)? Do you do it? Do you find any problems/ challenges to track and calculate the costs? What are your observations on adopting those techniques in the farm?
    b) If no, why not?

Question 6, 7, and 8 will be asked if the interviewee has not answer these questions as part of earlier answers :

6. What makes your farm focus on environmental issues? To what extent can you take the initiative to suggest actions or policies to reduce your organisation's environmental impacts?
7. Are there any environmental compliance requirements that you have to abide by at either the national or provincial level? How do you make sure that your organisation's activities meet these requirements and regulations?
8. How has your current environmental management influenced your farm goals and planning?
9. Do you think environmental conservation is an important element in your farm management? Has it influenced your current business operations? How? In what way?

10. In terms of dairy effluent discharge and other waste:
    a) How frequent do you monitor and document usage, volumes and disposal of the waste generated? What do you do with the information?
    b) How do you dispose of the waste?
11. In terms of products, services and operations:
    a) Can you share any instances where you had to consider not only your farm's goals but also environmental issues? Can you expand on that?
    b) What would you do if you've misjudged a particular project and find that you are directly affecting the community or the environment?
12. Earlier you mentioned that your farm conducts monitoring and documentation of your environmental costs (if applicable).
    a) Do you have any consultants/ third party helping you to ensure that the environmental practice is in line with the regulations?
13. Does your organisation produce an annual Environment Report? If so, is it externally verified or validated? Why do you prepare these annual reports?
14. Could you let me know your suggestions for improving the identification of environmental costs and decision-making process in order to increase efficiency and performance of the farm?

<u>Farmers' Perceptions on goals/outcomes of regulators</u>

1. What do you see as their primary focus? How does the environment fit into it?
2. What are your views regarding the environmental stewardship priority of the regulators? (What are they not covering or what needs more emphasis? What could they improve on for you?
3. What support and interaction do you get from them? (workshops, training days, environmental and land planning programmes, focus groups)
4. What sort of services or activities, if any, do you think regulators have implemented to help farmers to ensure they "do the right thing"?

For the regulators

1. What do you think about environmental sustainability and how does it relate to farming?
2. What commitments has your organisation made in regard to caring for the environment, especially for the dairying industry? How does your organisation monitor its commitments to looking after the environment? [Interviewer: follow-up questions if the following issues are not mentioned: What policies / rules / regulations do you have in regards to environmental management? What management information is collected from farmers? By whom? And who uses it?]
3. How does your organisation communicate, encourage and get farmers' understanding of your organisation's environmental decision making? Do you perceive Canterbury farmers are interested and concern about how you manage the environment when making decisions? Why do you think they are that way?
4. How do you ensure your departmental objectives and targets reflect the government's concerns about preserving the environment?
5. With regards to monitoring and measuring whether farmers' operations and activities affect the environment:
    a) How frequently must farmers report?
    b) How frequently do you conduct inspections?
    c) How are the measures used?
    d) Who are the users?
    e) What is the purpose of monitoring farmers' activities that affect the environment?
6. Is accountability for environmental protection and sustainable development performance and environmental compliance principally handled in a centralized or a decentralized fashion across New Zealand or a combination of the two? Do you think this is the best way to handle compliance?
7. How do you ensure farmers comply with the current rules and regulations? Do you find any problems/ challenges in ensuring farmers abide with the rules?
8. Are there any resources or support given to farmers that will help them improve their environmental performance? If yes, what are they? Are they utilizing the resources in the right way? Do they fulfil the organization's expectations?
9. What do you think farmers can do to improve their current practice in relation to environment management? What could be changed?

For Federated Farmers

1. What do you think about environmental sustainability and how does it relate to farming?
2. What is the primary focus of Federated Farmers? How does environmental sustainability fit into it?
3. What support and interaction are available for the farmers? (workshops, training days, environmental and land planning programmes, focus groups)
   Do they fulfil your expectations? Is it a choice or a requirement?
4. What do you see as the main reason farmers join Federated Farmers (internal factors, external factors)
5. How could your organization improve what is being done to help the farmers in relation to care for the environment?
6. What are the future plans to improve environmental protection and sustainable development?

Appendix 5: Human Ethics Committee Approval Letter

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2020/18/LR

21 August 2020

Inani Husna Binti Zamri
Accounting and Information Systems
UNIVERSITY OF CANTERBURY

Dear Inani

Thank you for submitting your low risk application to the Human Ethics Committee for the research proposal titled "Environmental Management Accounting in the Agriculture Industry".

I am pleased to advise that this application has been reviewed and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 14th August 2020.

With best wishes for your project.

Yours sincerely

Dr Dean Sutherland
Chair, Human Ethics Committee